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CONTENTS

Claude R. Wood, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Clinical Results with Monocaine as a Local Anesthetic.
M. L. Tainter, M.D., and A. H. Throndson, D.D.S. 1209
Preventive Orthodontics for the General Practitioner.
Frank F. Lamons, D.D.S. 1219
Bilateral Dentigerous Cyst of Mandible.
G. Victor Boyko, D.D.S.; John W. Surgent, D.D.S., and Alex M. Mohnac, D.D.S. 1226
Mandibular Subperiosteal Swellings Occurring in Children.
Charles E. Loveman, A.B., D.D.S. 1230
Application of Basic Sciences to Gold Inlay Fabrication.
E. S. Smyd, D.D.S., B.S.D. 1235
Conservative Treatment of Pulpless Teeth.
Louis I. Grossman, D.D.S., Dr.med.dent. 1244
Sulfanilamide and Urea in the Treatment of Osteomyelitis.
Clyde B. Kayne, D.D.S. 1251
Analysis and Control of Postoperative Complications in the Mandibular Third Molar Area.
J. P. Henahan, D.D.S. 1255
Use of Silver Nitrate in the Treatment of Caries.
H. A. Zander, M.S., D.D.S. 1260
A Simplified Technic for Copper Plating Impressions for Inlay Work.
B. D. Lynn, D.D.S. 1268
Esthetics: Selection of Teeth and Correlated Factors.
Earl L. Richey, D.D.S., M.S.D. 1270
Corrosion of Dental Alloys.
Irl C. Schoonover, Ph.D., and Wilmer Souder, Ph.D. 1278
Use of Germicides in Modern Aseptic Technic.
Antone O. Mickelsen, Ph.C., M.S., D.M.D. 1291
Vincent's Infection.
F. D. Francis, B.S., D.D.S. 1296
Treatment of Periodontal Disease: Preventive Phase.
John Oppie McCall, D.D.S. 1303
The Development of the National Board of Dental Examiners.
Morton J. Loeb, D.D.S. 1309
Full Upper and Lower Denture Rebasing Under Masticatory Pressure.
Ernest C. Reock, D.D.S., and Saul M. Gale, LL.B., D.D.S. 1320

EDITORIAL DEPARTMENT

Cancer Prevention 1325
Dentistry as a Professional Career 1328

Bibliographical 1329

ASSOCIATION ACTIVITIES

President's Page—Committee on Dental Preparedness—Council on Dental Therapeutics—Council on Dental Education—Bureau of Public Relations—Committee on Legislation—A.D.A. Annual Meeting—American Dental Association Membership—News Items—Correspondence ..... See Special Contents for Association Activities, page 1331

OBITUARIES

R. D. Griffis, D.D.S. (1869-1941) 1366
Deaths 1366

Current Literature 1367
Announcements 1374

ADVERTISEMENTS

Index to Advertisements A-51
Classified Section A-40

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CLINICAL RESULTS WITH MONOCAINE AS A LOCAL ANESTHETIC

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MONOCAINE, which is closely related chemically to procaine, was synthesized by Goldberg in 1935.[1] It was introduced as a local anesthetic in dentistry with the claim that it was more useful than procaine and had fewer toxic actions. Chemical data on its preparation were published by Goldberg and Whitmore in 1937,[2] and information on its pharmacologic actions and anesthetic potency by Abramson and Goldberg in 1938.[3] In the same year, three different workers[4, 5, 6] reported clinical evidence that monocaine was an effective local anesthetic, with diminished toxicity and increased speed of action as compared with procaine.

Goldberg claimed that the anesthetic potency of monocaine was higher than that of procaine, so that, although its toxicity for animals was greater, the margin of safety between the toxic and the effective dose was wider. The concentration originally advised for clinical use was 0.75 per cent, combined with 1:75,000 epinephrine. Since, recently, the strength of monocaine has been changed to 1 per cent, apparently the original solution was somewhat inadequate in anesthetic power. Whether the claim previously made that there is a wider margin of safety with the 0.75 per cent solution is true for the 1 per cent now solely used remains to be answered.

In 1939, the Council on Dental Therapeutics of the American Dental Association issued a preliminary report[7] on monocaine hydrochloride in which they summarized the claims that had been made for it, and pointed out that there was not enough evidence available at that time to substantiate the claims and to make the compound acceptable. In 1940, Butts and Koelle[8] repeated the claims for a wider margin of safety for the monocaine solution. However, their evidence for toxicity was based on an entirely inadequate number of animals. They also confirmed an earlier claim that monocaine was synergistic with epinephrine, since a mixture of the two

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caused greater vasoconstriction than the same amount of epinephrine alone, or procaine plus epinephrine. In this respect, monocaine might differ from procaine, which, being a mild vasodilator, antagonizes to a minor degree the vasoconstriction produced by epinephrine. The data in support of these claims of synergistic action were tenuous and unsatisfying, since the differences reported were well within the range of experimental error, and there was no indication that the sources of variation were recognized and controlled in an adequate manner.

Considerably more persuasive were the reports by Gaffney[9] and Adelman,[10] who studied the effects of monocaine in a series of mandibular injections. Gaffney used a range of concentrations of the local anesthetic with various amounts of epinephrine, and concluded that 1 per cent monocaine containing either 1:75,000 or 1:100,000 epinephrine was suitable for clinical use. Lower concentrations of epinephrine or of monocaine were unsatisfactory. However, Gaffney reported that the best solution of all was the 0.75 per cent solution marketed by the manufacturer, which was weaker than the freshly prepared 1 per cent which he thought was the best of his own solutions. He also concluded that severe postoperative complications followed use of the solutions, except those commercially marketed. Unless the manufacturer modified the composition of the ampuled solutions in a way not revealed by the labels, Gaffney used a solution identical with that in the ampules for at least part of his studies. Therefore, it is difficult to understand how the wide differences in the responses to these supposedly identical solutions could have occurred. It is probable that the number of cases used with each solution was inadequate as a basis for conclusions, and, therefore, Gaffney's investigation was inadequate from this standpoint.

The following year, Adelman[10] made a more extensive study, in which 201 patients were given mandibular injections, to compare the effects of monocaine and procaine. The standard 2 per cent procaine containing 1:50,000 epinephrine was compared with 1 per cent monocaine containing 1:75,000 epinephrine, and with a solution of the same composition supplied by the manu-

TABLE 1.—AMOUNT AND DISTRIBUTION OF DATA IN THE CLINICAL COMPARISON OF MONOCAINE AND PROCAINE AS LOCAL ANESTHETICS

Solution	Total Number of Patients	Total Number of Areas Injected	Average Number of Blocks per Patient	Type of Injection (Number and Percentage of Total Cases)		
				Mandibular	Tuberosity	Infra-Orbital
Procaine	123	193	1.57	72 37.3%	59 30.6%	62 32.1%
Monocaine	128	191	1.50	91 47.6%	48 25.1%	52 27.2%
Totals	251	384	1.53	163 42.4%	107 27.9%	114 29.7%

facturer. The procaine-epinephrine solution made up by Adelman did not contain sodium bisulfite, whereas both the monocaine solutions contained this agent in a concentration of 0.1 per cent. We have already shown[11, 12] that sodium bisulfite modifies, in several important respects, the response to local anesthetics, and, therefore, this uncontrolled variable would have to be taken into consideration before conclusions could be drawn as to the actual differences between procaine and monocaine.

The hydrogen ion concentrations of Adelman's freshly made solutions were measured daily, with results that indicated some serious defect in his procedure. He reported that the procaine solution varied in pH between 4.3 and 7.1, and the monocaine, between 3.4 and 6.8. These wide ranges of variation for solutions which were supposedly identical indicates either that the composition of these solutions was not constant or that the measurements of hydrogen ion concentration were unreliable. The latter seems unlikely, since fairly constant values ranging between 3.75 and 3.9 were observed in the solutions made by the manufacturer. If the composition of the solutions which they made up were so variable as to give the wide differences in pH reported, it is difficult to judge whether the clinical observations made with them can be relied on as being representative of what authentic solutions would do.

In Adelman's report, there is also not sufficient consideration of the variability between patients to permit one to judge whether the differences among the three solutions used were accidental variations or were due to inherent differences in the solutions. Judging from the values in Adelman's report, the efficiency of procaine and monocaine, in the concen-

TABLE 2.—COMPARISON OF AVERAGE EFFECTS OF ANESTHETIC SOLUTIONS CONTAINING MONOCAINE AND PROCAINE

Solution	Volume Required per Patient (Cc.)	Time of Onset Anesthesia (Minutes)	Duration Anesthesia (Hours)	Pulse Rate Changes (Beats per Minute)	Blood Pressure Changes (Mm. Hg.)		Respiratory Rate Change per Minute
					Systolic	Diastolic	
Procaine	5.4	2.8	2.7	+5.1	+1.7	−2.3	+1.1
Standard error* of average	±0.29	±0.12	±0.24	±1.04	±1.10	±0.90	±0.34
Monocaine	5.0	2.9	3.9	+3.3	+1.5	−3.5	+0.8
Standard error of average	±0.28	±0.13	±0.43	±1.02	±1.44	±0.94	±0.37
Probability of difference between procaine and monocaine being due to chance	38%	99%	1.7%	23%	92%	36%	50%

*The standard error values indicate the amount of variability to be expected in the average values to which they relate. The probability value represents the odds, expressed as per cent, that the differences between the averages could have resulted from chance. The lower the probability percentage, the greater the chance that the differences are true and not the result of accidental fluctuations in the individual values. The probability value should be smaller than 5 per cent before it is safe to conclude that a true difference exists between the solutions.

TABLE 3.—COMPARISON OF FREQUENCY OF IMMEDIATE EFFECTS EXPRESSED AS PERCENTAGES OF TOTAL NUMBER OF PATIENTS RECEIVING INJECTIONS OF MONOCAINE AND PROCAINE SOLUTIONS

Solution	Frequency of Incomplete Anesthesia	Frequency of Painful Injections	Amount of Bleeding			Frequency of Side Actions				Frequency of Completely Satisfactory Anesthesia
			Slight	Moderate	Excessive	Perspiration	Nervousness	Tremor	Fainting	
Procaine	20.0	14.1	11.9	58.5	29.7	18.3	34.7	8.3	5.8	83.9
Standard error of percentages	±3.58	±2.51	±2.96	±4.54	±4.26	±3.53	±4.33	±2.51	±2.23	±3.30
Monocaine	23.3	24.7	11.3	61.3	27.4	17.0	50.0	9.7	16.0	79.1
Standard error of percentages	±3.04	±3.13	±2.32	±3.57	±3.27	±2.74	±3.65	±2.17	±2.67	±3.23
Probability of difference between procaine and monocaine being due to chance	48%	0.8%	60%			77%	0.7%	68%	0.3%	30%

trations used, was much the same. Monocaine caused reactions of similar extent and frequency to those of procaine, and there were greater differences between the commercial monocaine solution and that prepared extemporaneously in the laboratory than there were between the monocaine and procaine solutions. This makes it appear that the differences, to which Adelman ascribed significance, resulted primarily from variations in the clinical material or unsuspected changes in the composition of the solutions rather than from true differences between the effects of procaine and of monocaine.

Worthy of emphasis, because of similar results in our tests, is the fact that there were more undesirable postoperative complications with monocaine, in Adelman's series, since, in his Table 10, there were fourteen complications in ninety-nine patients, or 14.1 per cent, after procaine injection, and twenty-three complications in 102 patients, or 22.5 per cent, after monocaine injection. In view of our discovery that solutions containing sodium bisulfite break down on standing, with production of acid and other irritating substances,[12] Adelman's conclusion that fresh solutions permitted better healing than did the more acid commercial solution, prepared some time before, was consistent with our results. His monocaine solutions contained equal amounts of sodium bisulfite, but the freshly prepared solutions had less time for decomposition than the commercially prepared ampuls.

Finally, in 1940, Wilkie[13] reported mandibular or infiltration injections of monocaine in fifty-seven patients, and of procaine in forty-two, using a procedure substantially like that developed by us and described in THE JOURNAL previously.[12, 14, 15, 16, 17] The concentration of monocaine was 0.75 per cent in 1:75,000 epinephrine and 0.1 per cent bisulfite. The procaine solution was of 2 per cent strength in 1:50,000 epinephrine, with

the same concentration of bisulfite. Wilkie concluded that approximately the same volumes of solutions were necessary for the two anesthetics, and that the depth of anesthesia was quite similar, but that anesthesia with monocaine occurred more rapidly than that with procaine. The effects on blood pressure and respiration were so similar that they might have been due to inherent variability in individual patients. In a slightly smaller percentage of the procaine cases, there were no reactions to this local anesthetic, but again the differences were probably too small to be significant. The amount of bleeding observed from the two solutions was quite similar. Although Wilkie stated that the duration of anesthesia was recorded, the results are not given. His general conclusion was that monocaine compared very favorably with procaine as judged by the total response of patients in a somewhat limited series.

In view of the inconclusive character of the evidence thus far published regarding the relative merits of monocaine, it was thought worth while to reinvestigate this agent more extensively in this institution, studying both its pharmacologic properties and toxicity and the clinical effects in patients undergoing ordinary oral surgical procedures. The pharmacologic results will be published separately. This report presents the results of clinical tests with this anesthetic.

METHODS

The method used in the present study was to compare monocaine and procaine by means of the "blind test technic," which has been repeatedly described in reports from this institution.[12, 14, 15, 16, 17] In essence, this technic consisted of supplying the oral surgery staff with solutions of either procaine or monocaine, identified only by noninformative numbers, which were changed frequently, so that the operators had no knowledge of the composition of the solution being used at any particular time. A trained observer, who also did not know the composition of the solutions, made continuous observations on the patients, recording the pertinent data on mimeographed forms. When a sufficient number of patients had been observed, the records were segregated according to the solution used, the data tabulated and the averages computed, together with estimates of their statistical validity. The results so obtained have been summarized. (Tables 1, 2, 3 and 4.)

Solutions Used.—The procaine solution used contained 2 per cent procaine hydrochloride with 1:50,000 epineph-

TABLE 4.—COMPARISON OF FREQUENCY OF LATE EFFECTS OF INJECTION OF MONOCAINE AND PROCAINE LOCAL ANESTHETIC SOLUTIONS, EXPRESSED AS PERCENTAGES OF TOTAL NUMBER OF PATIENTS

Solution	Late Pain at Injection Site	Swelling at Injection Site	Trismus	Septic Alveolus (Dry Socket)	Inflammation at Operative Site
Procaine	35.9	38.2	41.3	7.9	71.1
Standard error of percentage	±5.43	±5.57	±5.69	±3.09	±5.20
Monocaine	50.6	41.6	40.0	10.3	87.0
Standard error of percentage	±5.70	±5.62	±5.66	±3.44	±3.83
Probability of difference between procaine and monocaine being due to chance	6%	66%	86%	60%	1.4%

rine, 0.7 per cent sodium chloride and 0.1 per cent sodium bisulfite. The monocaine solution contained 1 per cent monocaine hydrochloride with 1:75,000 epinephrine, 0.1 per cent sodium bisulfite and 0.8 per cent sodium chloride. The solutions were sterilized in an autoclave each day before use. Control observations, to be reported later, showed that this method of sterilization did not modify the anesthetic power of these solutions.

Number of Patients and Injections.—As shown in Table 1, 123 patients were given procaine, receiving a total of 193 injections; as compared with 128 patients given monocaine and who received a total of 191 injections. The nerve blocks used were mandibular, tuberosity and infra-orbital in approximately equal proportions, except that there were 10 per cent more mandibular injections with monocaine than with procaine. A marked difference between the mandibular responses and those of other injections would affect the validity of conclusions drawn from the over-all averages. Therefore, the results were analyzed for each type of injection separately and only combined in an average value, when no statistically reliable differences between the types of injections were present.

CLINICAL RESULTS

Volumes Required.—Table 2 contains a summary of the results with the volumes of solutions required for anesthesia with the two solutions. An average of 5.4 cc. of procaine was used for each patient, as compared to 5.0 cc. of monocaine. This suggested that the procaine was slightly less effective. However, in determining the volume of solution used for each block, it was necessary to take into consideration the fact that there were 1.57 injections or nerve blocks in each patient receiving procaine, as compared to 1.50 in each receiving monocaine. Therefore, when the volumes were divided by the number of injections, there was an average of 3.43 cc. of procaine for each nerve block as compared to 3.36 cc. of monocaine. Therefore, the two solutions required nearly identical volumes for each region or nerve anesthetized. A slightly larger volume of solution was required for the mandibular blocks; i.e., an average of 3.7 cc. as compared to 3 cc. for tuberosities, and 3.1 cc. for infra-orbital injections. However, since the same differences were present with both the monocaine and the procaine solutions, the anesthetic injected was not responsible for these. Calculations regarding the probability that the differences between these two solutions were great enough to be significant showed that they were the result of chance differences between patients. As pointed out before in the statistical analysis of such data,[12, 14, 15, 16, 17] unless the probability of difference is 5 per cent or less, the odds in favor of the differences observed being due to random variations between patients are too great to permit justifiable conclusions.

Onset and Duration of Anesthesia.—Anesthesia occurred in an average of 2.8 minutes with procaine and 2.9 minutes with monocaine, an indication that the time of onset was practically identical. Anesthesia was complete in about four of five patients with both solutions; again no difference. The duration of anesthesia with procaine was 2.7 hours as compared with 3.9 hours with monocaine. In other words, the monocaine anesthesia lasted an average of seventy-two minutes longer than did the procaine, a difference altogether too large to be ascribed to chance sampling. The longer duration was more striking, when it is kept in mind that the monocaine solution contained less epinephrine than the procaine solution, and the length of anesthesia increases with increased concentrations of the vasoconstrictor.[15] This might be due to a vasoconstrictor power of monocaine itself, something which has been alleged for this agent. Or, by potentiat-

ing or adding to the vasoconstriction produced by epinephrine, monocaine might prolong the action beyond that due to the 1:75,000 epinephrine present. If this were correct, the effect of added or superior vasoconstriction should be reflected in the amount of bleeding resulting with the two solutions, since increased vasoconstrictor activity causes a decrease in loss of blood. However, the data in Table 3 on the amount of bleeding indicate that blood loss was substantially identical with the two solutions. Therefore, the cause of the longer action of the monocaine cannot be ascribed to an added vasoconstrictor power, but rather to a more persistent action of the monocaine on the sensory nerves.

Vital Functions.—The pulse rate was increased an average of about five beats per minute with procaine as compared with three beats per minute with monocaine. The difference was too small to be significant, in view of the large differences between individual patients. In addition, when the changes were further analyzed by calculating independently the number of patients in whom the pulse rate was increased or decreased, it was found that these numbers were quite alike and that there were as many patients in whom excessive changes in rate occurred with the one solution as with the other. A similar analysis of the changes in both systolic and diastolic blood pressure revealed that the actions were quite similar. Both solutions increased the average systolic pressure by less than 2 mm. and decreased the diastolic by about 3 mm. Again, the individual records showed that there were as many cases of large increases or decreases in one series as in the other, so that the blood pressure was not affected in any differential manner. The changes in respiration were very small and were similar with the two solutions. These results indicated that the circulation and respiration were affected by the two solutions in a similar manner, and that no basis existed for preferring one solution to the other, as far as these functions were concerned.

Irritation from the Injections.—Occasionally, local anesthetic solutions cause irritation or stinging sensations immediately after injection. Part of this may be the prick of the needle, but more often it is due to actual irritation of the nerve fibers by the solution. In 14 per cent of the patients given procaine, the injections caused pain, as compared to 25 per cent with monocaine, a value which is considerably greater. Calculation of the probability percentage reveals that such a difference could not have occurred by chance as often as once in 100 such series of observations. Therefore, it appeared that injection of monocaine was more painful than injection of procaine and that it caused more immediate tissue irritation. The difference was all the more significant since these agents cause local anesthesia, which tends to mask any irritant effects. The results show that about one patient in every four injected with monocaine complained of pain, as compared to one patient in seven with procaine; a difference which may be important clinically.

Reactions.—The surgeon is also interested in the reaction of the patient in the chair as indicated by perspiration, nervousness, tremor or fainting. Perspiration occurred in 18 per cent of patients given procaine as compared with 17 per cent given monocaine, and tremor in 8 per cent given procaine and 10 per cent given monocaine, differences which are entirely negligible. Thirty-five per cent of patients were made nervous by injection of procaine as compared with 50 per cent by monocaine injection; a difference of 15 per cent, too great to be due to variations in patients. A patient was regarded as having a fainting reaction whenever he felt faint or dizzy enough to require lowering of the head or a temporary delay in the operation in order to prevent loss of consciousness. This occurred in 5.8 per cent of the patients receiving procaine as compared with

16 per cent of those given monocaine. This difference against the monocaine of almost three times indicates that monocaine produced a much greater reaction of this type than did procaine. When this is considered in conjunction with the greater amount of nervousness, it is seen that monocaine produced considerably more reaction in patients during the operations than did procaine and, therefore, monocaine was clinically more toxic.

Satisfactoriness of the Anesthesia.—At the end of each operation, the surgeon recorded whether in his opinion the anesthesia had been completely satisfactory or not. There was complete satisfaction in 83.9 per cent of the patients who had received procaine as compared with 79.1 per cent of those receiving monocaine. This difference of approximately 5 per cent is too small to be stressed although it proves, at least, that the monocaine solution was not superior as judged by the operators at the time.

Postoperative Effects.—Of great importance in all surgical procedures is the condition of the tissues postoperatively. A local anesthetic solution which causes irritation damages the tissues in the area injected and causes pain, swelling and trismus of muscles, resulting in an uncomfortable convalescence. It is, therefore, important that the local anesthetic solution be as non-irritant as possible and have no disadvantageous secondary effects. Unfortunately, it was not possible to get complete follow-up records on all patients, since some were unable or unwilling to return for adequate observation. However, since those who had no postoperative complications were less likely to return than those who had, the apparent percentage frequency in these is overstated rather than the reverse (Table 4).

Pain at the site of injection of the local anesthetic was observed postoperatively in 36 per cent of the patients after procaine as compared with 51 per cent after monocaine injection. This difference of 15 per cent is large enough to indicate that the injected areas were painful more frequently after monocaine than after procaine injection. However, the difference was not great enough to be conclusive, since the probability value was only 6 per cent. This meant that there were only six chances out of a hundred that a difference as large as this could have occurred from chance variations in the patients, which gave a reasonable assurance that there was a true difference between the two solutions in this respect. As regards amount of swelling at the site of injection and trismus, there were no differences between the two solutions.

Septic alveolus, or dry socket, severe enough to require postoperative treatment, occurred in 7.9 per cent of patients after procaine as compared with 10.3 per cent after monocaine injection. Apparently, there were about half again as many cases of dry socket after monocaine as after procaine injection, but because these were relatively infrequent in both series, the differences were not great enough to afford a basis for conclusions, as shown by the probability percentage. Inflammation at the site of operation is largely the result of the severity of the operation. However, when one anesthetic solution restricts the circulation in the operative zone longer than another, the chance for infection is increased, and may be expected to result in increased inflammatory reactions in this area. Such reactions were observed in 71 per cent of the patients receiving procaine injections as compared with 87 per cent of those receiving monocaine. This difference of 16 per cent against the monocaine is too large to be dismissed as being due to variations between the patients themselves, indicating that, in all probability, monocaine injection made the tissues at the site of operation more susceptible to postoperative complications and, therefore, had additional undesirable sequelae.

The results of these observations taken together indicate that in no respect was

monocaine better than procaine as far as the postoperative course was concerned. Where there was a difference, the monocaine was less desirable than the procaine. These observations, therefore, are not in accord with previous assertions that monocaine is less toxic as an anesthetic than procaine, at least as regards tissue injury.

SUMMARY AND CONCLUSIONS

1. Two hundred and fifty-one patients were observed for comparison of monocaine and procaine as local anesthetics in oral surgical procedures. Each patient received either 2 per cent procaine hydrochloride containing 1:50,000 epinephrine or 1 per cent monocaine hydrochloride containing 1:75,000 epinephrine, both agents being dissolved in a sodium chloride solution containing 0.1 per cent sodium bisulfite. A total of 384 injections were made in these patients, giving an average of 1.53 injections or regions blocked in each. Segregation of the data according to mandibular, tuberosity or infra-orbital injections showed that these three injections were used with as nearly the same frequency in the two series as to warrant use of the average values for comparison.

2. Procaine required 5.4 cc. per patient as compared with 5.0 cc. for monocaine, but since, with monocaine, regions blocked in each patient averaged 1.5 as compared with 1.57 for procaine, the average volume of solution required with both solutions was about 3.4 cc. for each nerve or region blocked.

3. The average time of onset of anesthesia was nearly identical with the two solutions, 2.8 and 2.9 minutes, respectively, being required.

4. The duration of the anesthesia was definitely longer with monocaine than with procaine, i.e., an average of 3.9 hours for monocaine as compared with 2.7 hours for procaine. This longer action was probably the result of a more persistent effect of the monocaine directly on the nerves, since the vasoconstriction for the two solutions was substantially equal.

5. Changes in blood pressure, pulse rate and respiration were similar though minor, with the two solutions.

6. Anesthesia was incomplete in about equal frequency with the two solutions, this indicating that there was no substantial difference between monocaine and procaine as to diffusibility through tissues and penetrability of nerve structures.

7. Monocaine caused more tissue irritation than procaine at the time of injection, there being a 24.7 per cent frequency of painful injections after monocaine as compared to 14.1 per cent after procaine injection. This greater local tissue irritation from monocaine agreed with the more marked postoperative reactions at the site of injection.

8. No difference in the amount of bleeding during the operation was observed between the two solutions. If the monocaine-epinephrine solution had different vasoconstrictor power than the procaine-epinephrine solution, this should have been revealed by different frequencies of bleeding, which were not observed. Accordingly, 1:50,000 epinephrine in the presence of 2 per cent procaine produces substantially the same degree of vasoconstriction as 1:75,000 epinephrine in 0.75 per cent monocaine. The explanation of this is not given by the present data.

9. During the course of the operations, the side actions of perspiration and tremor were equally frequent with the two solutions. However, only 34.7 per cent of the patients were nervous after procaine as compared with 50 per cent after monocaine, and only 5.8 per cent of the patients receiving procaine became faint as compared with 16 per cent receiving monocaine. These differences, which are too large to be discounted as chance variations, indicate that monocaine caused considerably more systemic reaction than did procaine, under the conditions.

10. Anesthesia was completely satisfactory to the surgeons in 83.9 per cent of the patients receiving procaine as compared with 79.1 per cent of those receiving monocaine. This difference, too small to be significant, suggests that the operators did not feel that monocaine gave them a completely satisfactory anesthesia any more frequently than did procaine. This objective result controverts the claims of others and illustrates the necessity of using a true "blind-test" technic if conclusions are not to be vitiated by subjective impressions.

11. During the postoperative period, the amount of swelling at the site of injection of the local anesthetic, the amount of trismus or muscle spasm and possibly the incidence of septic alveolus were similar after procaine and monocaine. On the other hand, there was more pain at the site of the injection after monocaine, as well as a greater amount of postoperative inflammation and swelling in the operative area. Therefore, the greater tissue irritation, indicated by the more frequent painful injections with monocaine, was also apparent in the increased incidence of postoperative complications of pain and inflammation.

12. When 1 per cent monocaine is used in place of 2 per cent procaine, the same degree of local anesthesia will probably be obtained. However, the monocaine anesthesia will probably last longer than the procaine, and the greater duration will be accompanied by more pain, increased reaction while the operation is going on and a more uncomfortable postoperative period. As the duration of anesthesia is seldom of crucial importance and since most dental operations are relatively brief, it would appear that the prolonged action with monocaine is not sufficiently important to justify its use, in view of its greater tissue injury and systemic toxicity. Therefore, monocaine, as a local anesthetic, has little advantage over procaine, and certain definite and serious disadvantages. There is no good reason for preferring this newer agent over the well-established procaine hydrochloride, even though the monocaine will be fairly satisfactory when special indications for its use exist.

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PREVENTIVE ORTHODONTICS FOR THE GENERAL PRACTITIONER

By Frank F. Lamons, D.D.S., Atlanta, Ga.

Of the many branches and specialties of dentistry known today, in reality only two great classes exist: one, dentistry for adults, the other, dentistry for children.

The aim or purpose of dentistry for adults is the restoration of the teeth and supporting structures in the mouth to health and function, when they have become impaired by disease. In this class of dentistry are listed the well-known services performed by the profession such as filling teeth, making crowns, bridges and dentures, treating pyorrhea and numerous other operations familiar to all of you. This class of dentistry concerns itself with the problem at hand, or the needs of the patient at the moment, and, generally speaking, the service goes no farther than the completion of the work necessary at the time.

The aim or purpose of dentistry for children is much broader in its scope and in its application to the needs of the patient. This statement is justified by the fact that some concern must be felt for the future dental welfare of the patient. To be sure, the teeth and supporting structures must be restored to health when impaired by disease. This means filling the deciduous teeth, treating diseased tissues, extracting infected teeth, prophylaxis and many other operations which are a part of the service that dentists are rendering to children. There is still another great and important factor in the rendition of a full and complete service to our younger patients. This is planning for the future dental life of the child. It is a proper appreciation by the dentist of the services rendered as they may affect the future growth and development of the particular mouth under treatment. In the great majority of cases, nearly every operation performed for the child has its effect on the future growth and development, speaking from a dental standpoint. Is it not logical, then, to say that some concern must be felt for the future of the individual under treatment?

Preventive orthodontics embodies, in principle, planning for the future, and the execution of such services as may assist in the normal growth and development of the jaws and arches. With this thought must come the realization that the jaws of children grow with the passing years, and, with this growth, there comes the development from the jaws of a child to those of an adult. Not only are all of the deciduous teeth replaced by permanent teeth, but also new teeth (the permanent molars) are added on to the posterior portions of the arches as they grow. The exfoliation of the deciduous teeth, the eruption of their successors and the addition of the permanent molars in the posterior portions of the arches are physiologic changes taking place in every child, but they are so common that little attention is paid them until some abnormality develops. These phenomena we accept because they are ever present, and we pass on to the operative procedures with the feeling that we are rendering a true service to our

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patients. The question can easily be raised, Are we rendering a full service? The answer must be, No. We must be concerned with the physiologic changes of growth and development taking place in the jaws and arches of our young patients. The general practitioner who renders service to children is in a position to note the growth and developmental changes taking place.

It would seem from the foregoing that a better understanding of the growth changes taking place in the jaws and arches is essential to any program of preventive orthodontics. Such an understanding must include a clearer and more workable knowledge of the calcification and eruption of the permanent teeth and also of the deciduous teeth, and this would include the normal exfoliation time. For study along this line, a tabulation of Logan and Kronfeld, captioned "The Chronology of the Human Dentition" is recommended.

The writings of Milo Hellman on the eruption of the permanent teeth are also recommended, because of their particular application to the orthodontic problem.

In advising that more attention be given to the eruption of the teeth, due respect must be accorded variation. Variability is one of the first laws of nature. The exfoliation of deciduous teeth, the eruption of permanent teeth and the growth changes taking place in the jaws are all subject to the laws of variation. The arbitrary extraction of a deciduous tooth, without considering variation, because a child has reached a certain age may be damaging to arch form. Comparative roentgenograms of other areas in the arch should be helpful in diagnosis.

This presentation is addressed to the general practitioner, but it is also of concern to those interested in dentistry for children, and indeed to all members of the profession. They may all be called on at times to advise the parent about the

CHRONOLOGY OF THE HUMAN DENTITION

LOGAN and KRONFELD (slightly modified by McCALL and SCHOUR)

		Tooth	Hard Tissue Formation Begins	Amount of Enamel Formed at Birth	Enamel Completed	Eruption	Root Completed
Deciduous dentition	Maxillary	Central incisor	4 mos. in utero	Five-sixths	1½ mos.	7½ mos.	1½ yrs.
		Lateral incisor	4½ mos. in utero	Two-thirds	2½ mos.	9 mos.	2 yrs.
		Cuspid	5 mos. in utero	One-third	9 mos.	18 mos.	3¼ yrs.
		First molar	5 mos. in utero	Cusps united	6 mos.	14 mos.	2½ yrs.
		Second molar	6 mos. in utero	Cusp tips still isolated	11 mos.	24 mos.	3 yrs.
	Mandibular	Central incisor	4½ mos. in utero	Three-fifths	2½ mos.	6 mos.	1½ yrs.
		Lateral incisor	4½ mos. in utero	Three-fifths	3 mos.	7 mos.	1½ yrs.
		Cuspid	5 mos. in utero	One-third	9 mos.	16 mos.	3¼ yrs.
		First molar	5 mos. in utero	Cusps united	3½ mos.	12 mos.	2¼ yrs.
		Second molar	6 mos. in utero	Cusp tips still isolated	10 mos.	20 mos.	3 yrs.
Permanent dentition	Maxillary	Central incisor	3 - 4 mos.	....	4 - 5 yrs.	7- 8 yrs.	10 yrs.
		Lateral incisor	10 -12 mos.	....	4 - 5 yrs.	8- 9 yrs.	11 yrs.
		Cuspid	4 - 5 mos.	....	6 - 7 yrs.	11-12 yrs.	13-15 yrs.
		First bicuspid	1½- 1¾ yrs.	....	5 - 6 yrs.	10-11 yrs.	12-13 yrs.
		Second bicuspid	2 - 2¼ yrs.	....	6 - 7 yrs.	10-12 yrs.	12-14 yrs.
		First molar	at birth	Sometimes a trace	2½- 3 yrs.	6- 7 yrs.	9-10 yrs.
		Second molar	2½- 3 yrs.	....	7 - 8 yrs.	12-13 yrs.	14-16 yrs.
		Third molar	7 - 9 yrs.	....	12 -16 yrs.	17-21 yrs.	18-25 yrs.
	Mandibular	Central incisor	3 - 4 mos.	....	4 - 5 yrs.	6- 7 yrs.	9 yrs.
		Lateral incisor	3 - 4 mos.	....	4 - 5 yrs.	7- 8 yrs.	10 yrs.
		Cuspid	4 - 5 mos.	....	6 - 7 yrs.	9-10 yrs.	12-14 yrs.
		First bicuspid	1¾- 2 yrs.	....	5 - 6 yrs.	10-12 yrs.	12-13 yrs.
		Second bicuspid	2¼- 2½ yrs.	....	6 - 7 yrs.	11-12 yrs.	13-14 yrs.
		First molar	at birth	Sometimes a trace	2½- 3 yrs.	6- 7 yrs.	9-10 yrs.
		Second molar	2½- 3 yrs.	....	7 - 8 yrs.	11-13 yrs.	14-15 yrs.
		Third molar	8 -10 yrs.	....	12 -16 yrs.	17-21 yrs.	18-25 yrs.

child's dental health. Any advice given must relate itself either directly or indirectly to the future dental life of the child. This advice must be consistent with Nature's plan for the growth and unfolding of the jaws and arches, the exfoliation of the deciduous teeth and the eruption of the permanent teeth, to the end that the requirements of normal function, as well as of esthetics, will be met in the adult dentition.

tial to a sound diagnosis, upon which the operator plans for the future and works to that end. The changes taking place will be far more easily understood if adequate records of the individual patients are kept. These may be written records, supplemented by casts of the teeth, roentgenograms and photographs. But, whatever the record, something tangible for comparison at a later date is essential. A simple record to keep is a cast made

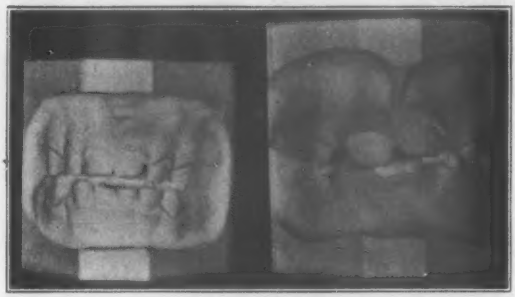

Fig. 1.—Cast from vestibule impression, showing anterior teeth. It is easy to make and simple, and it affords a permanent record for future reference.

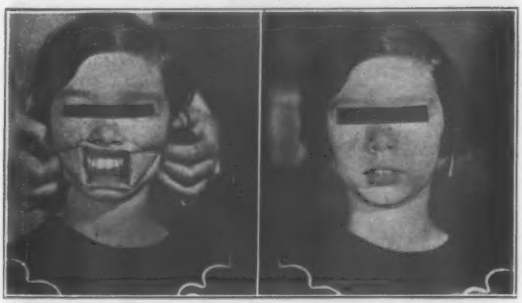

Fig. 2 (Case 1).—Front view showing prominence of upper teeth and parting of lips causing lower lip to roll downward.

Planning for the future, including preventive orthodontics, requires at least four essential services, which, for the purpose of discussion, may be listed as follows:

1. A fuller consideration of the growth and developmental changes taking place in the jaws and arches of the young patients. Such knowledge is essential to a sound diagnosis, upon which the operator plans for the future and works to that end. The changes taking place will be far more easily understood if adequate records of the individual patients are kept. These may be written records, supplemented by casts of the teeth, roentgenograms and photographs. But, whatever the record, something tangible for comparison at a later date is essential. A simple record to keep is a cast made from the vestibule impression. It may not show all the changes taking place in the arch form, but it conveys a great deal of information when viewed at a later date.

2. Correct anatomic restorations for the deciduous teeth. Emphasis on the importance of filling the deciduous teeth may not be necessary, but it is necessary

to emphasize the need of correct anatomic form in these fillings. The correct mesiodistal diameter must be restored, also the occlusal surface. Failure in this respect impairs masticatory function. The effect on the developing dentition may be slight, but a more serious condition may follow, because the functional activity of the teeth as a whole is below par. The stimuli received from vigorous mastication are distinctly helpful to the growing jaw and are an important factor in normal development. To maintain the best possible function of the teeth is perhaps the basis of all dentistry. Inlays, bridges, dentures and even periodontal care are but the means of maintaining function. How much more important it is to maintain good function of the teeth during the growing period! Correct anatomic fillings in the deciduous teeth do a great deal toward maintaining good function.

Fig. 3 (Case 1).—Profile view.

Fig. 4 (Case 1).—Model showing right and left sides.

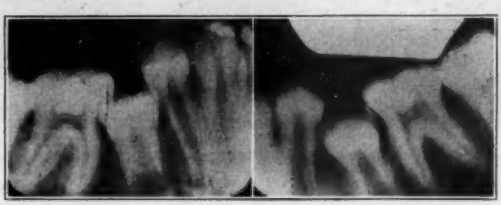

Fig. 5 (Case 1).—Impaction of lower second premolars.

3. A full-mouth roentgenographic survey at an early age. This is essential to any effort or thought for the future. The presence of supernumerary teeth, the absence of permanent teeth and the misplacement of permanent tooth buds can be detected only by means of the roent-

genogram. Failure to give our young patients the benefit of this aid to diagnosis certainly means failure to make a full and complete diagnosis. It is true that the majority of roentgenographic surveys may show everything to be normal, or, to express it differently, they may be negative to abnormal findings. Negative findings are just as important as positive findings when one is planning for the future, and positive findings occur frequently enough to warrant a careful roentgenographic survey of every child whose dental future is our responsibility. Follow-up roentgenograms give information indispensable in determining whether deciduous teeth are being retained too long. No deciduous tooth should be extracted until the presence or absence of its permanent successor has been determined. Either condition will require planning for the future unless extraction time precedes exfoliation time by a very short interval. In the absence of a permanent tooth to succeed the deciduous, there is no normal exfoliation time.

4. The judicious use of space maintainers. This is necessary to any operator who renders service to children. The term judicious is used because space maintainers are not always necessary when deciduous teeth are prematurely lost, but, in the majority of cases, they are necessary. I am convinced that, when in doubt, it is better for the patient to use one than to allow the case to pass on to a possible orthodontic problem.

Fig. 6 (Case 1).—Models after completion of orthodontic treatment; right and left views.

Fig. 7 (Case 1).—Front view three years after completion of orthodontic treatment. The position of the lips, which are normally held together when at rest, is to be noted.

I shall not attempt to defend the use of space maintainers in a lengthy discussion, since I am committed here to the subject of preventive orthodontics. I wish to emphasize that any program for the care of children requires of the operator

some plan and thought for the future. In planning for the future, the problem of space retention is a vital one. In support of this statement, I should like to present two orthodontic cases in which the etiology is unknown except for the fact that the deciduous teeth were lost prematurely, and no plans were made for the future. I am sure that these cases can be duplicated in any orthodontic practice. They are easily recognized.

Fig. 8 (Case 1).—Profile view of Figure 7.

Fig. 9 (Case 2).—Right and left views. The mesial movement of the upper first molars and distal movement of the upper second premolars are evident, as is closure of the space for the lower left second premolars.

CASE 1.—A girl, aged 10½ years, presented a case which had the appearance of an Angle Class II, Division 1 malocclusion, as will be seen by the photographs.

A closer study of the malocclusion reveals a molar relation that is practically normal, an extreme protrusion of all of the upper anterior teeth and a buccal position of both upper first premolars. Also, the lower second premolars are impacted, as the roentgenograms show.

A study of the etiology of this case reveals first a hereditary tendency to this condition, which was apparent in the teeth and arches of the mother, although her occlusion was satisfactory. The lower deciduous molars were lost at about 6 years of age.

It is apparent that no plan for the future development of this mouth was considered, and there is a general collapse of the lower arch. The remaining teeth were allowed to shift for themselves, disturbing normal function and upsetting the normal growth changes taking place during the next few years. It is safe to assume that the premature loss of the deciduous lower molars is the sole etio-

logic factor, even though there is the hereditary background. Properly constructed space maintainers would have at least reduced the severity of the malocclusion, and it is entirely possible that their use would have obviated orthodontic service by assisting in the normal and natural growth of the mandible. The use of space maintainers would have aided in maintaining function, and the influence of abnormal function is here a definite factor in a condition that might have been prevented.

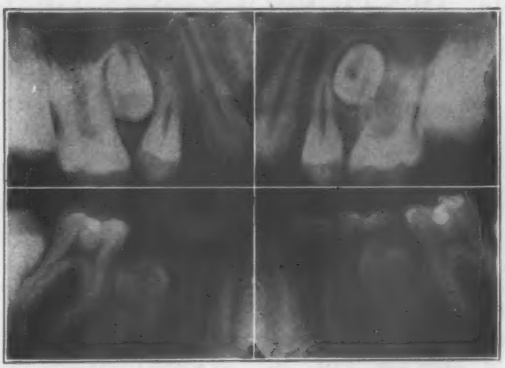

Fig. 10 (Case 2).—Severe impaction of upper second premolars; impaction of lower left premolar with normal position of lower right premolar in which deciduous molar was retained until normal exfoliation time.

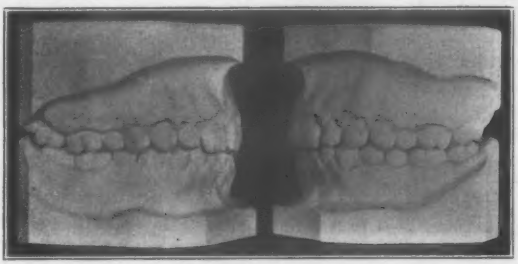

Fig. 11 (Case 2).—Model made after completion of extensive orthodontic treatment.

CASE 2.—A boy, aged 12, gave no evidence of any hereditary tendency to malocclusion or any other explanation of it except the premature loss of the upper second deciduous molars and the lower left second deciduous molar.

There was mesial movement and rotation of both upper first permanent molars, and distal movement of the upper first premolars to the extent that the upper second premolars were badly impacted. The lower left second premolar was impacted, but the lower right had been maintained in a normal position, as the roentgenograms show.

Here, we have evidence of disturbed growth and a normal condition in the same mouth. Three areas were disturbed owing to premature loss of deciduous teeth, while the fourth (the lower right), where the deciduous molar has been retained, appeared to be normal.

This case presents sufficient evidence to justify the statement that planning for the future is essential to the aims and purposes of dentistry for children. As such, it will include the judicious use of space maintainers and will become a preventive orthodontic service.

The technic of making space maintainers has been amply covered in the literature. It has been my purpose in this presentation to emphasize the fact that dentistry for children requires something in addition to the routine services usually performed, such as fillings, etc. This something we are pleased to call planning for the future. It is a consideration of the future growth and development of the jaws and arches as they may be affected by the services that we render or fail to render.

503 Doctors Building.

BILATERAL DENTIGEROUS CYST OF MANDIBLE

REPORT OF A CASE AND DISCUSSION OF FOLLICULAR CYSTS

By G. VICTOR BOYKO, D.D.S.; JOHN W. SURGENT, D.D.S., and ALEX M. MOHNAC, D.D.S., Paterson, N. J.

THE dentigerous cyst of the follicular type is one of several groups of pathologic growths arising from dental epithelium that involve the maxillae and mandible. This group of cystic lesions occur less frequently than the radiculodental or radicular cyst, but more so than the adamantinoma or ameloblastoma. These three classes of pathologic jaw lesions, namely (1) the radiculodental or radicular cysts, (2) all groups of the follicular class of cysts and (3) the adamantinoma or ameloblastoma, may occupy this same order with respect to the difficulties in diagnosis, the extent of tissue damage and the prognosis.

ETIOLOGY

The term dentigerous, to which group of cysts this report will confine itself, implies tooth-bearing. These cysts, that is the dentigerous type, always have a partly or completely formed tooth remnant within the sac-lined bone cavity. Therefore, the dentigerous cyst is the tooth-bearing type of the general classification of follicular cysts and should be distinguished from the follicular group presenting no tooth remnant. Furthermore, the term dentigerous should not be used ambiguously to include every type of jaw cyst of dental origin.

The etiology of the dentigerous cyst has been discussed under several theories. It seems reasonable that this type of cyst results from some form of irritation of the dental follicle. Trauma and infection induced at the appropriate period during tooth development may result in this cystic growth. Consequently, the dentigerous cyst begins growth during the formation of the tooth follicle, and progresses slowly and painlessly, but may result in an extensive bone cavity with considerable tissue destruction and involvement of multiple teeth. These cystic cavities are lined with a membrane the inner portion of which consists of squamous epithelium and which is attached to the root of the enclosed tooth remnant. These cysts, unless secondarily infected, may contain, in addition to the tooth remnant, a clear straw-colored fluid. The walls of the more extensive dentigerous cyst may be thinned and forced out of the normal jaw contour. This symptom of fulness frequently leads to discovery of the lesion.

From the Oral Surgical Service of the Paterson General Hospital, Paterson, N. J.

DIAGNOSTIC SYMPTOMS

The dentigerous cyst may involve any tooth in either jaw, but, more frequently, it is located in the cuspid and third molar areas. Follicles of supernumerary

Fig. 1.—Cortical fulness of mandible.

Fig. 2.—Left mandible; showing unerupted cuspid in position.

teeth may also be the site of these lesions. An early symptom leading to discovery of this growth is the absence of a tooth from the permanent arch. The x-rays and, in doubtful instances, the biopsy verify the diagnosis. The roentgenogram reveals the dentigerous cyst as a definitely outlined bone cavity within the jaw enclosing a tooth remnant.

TREATMENT

The principle of treatment for the

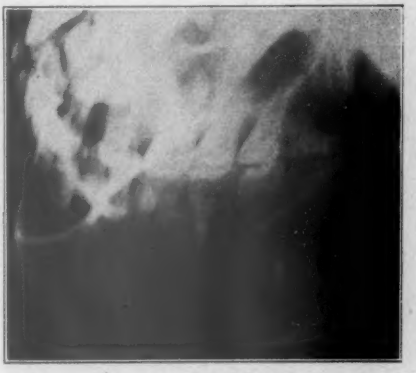

Fig. 3.—Right mandible; showing apical resorption of teeth within cystic cavity.

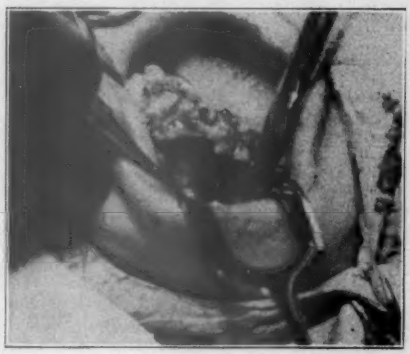

Fig 4.—Bone cavity after removal of cystic sac.

dentigerous cyst is exposure and enucleation of the cystic membrane. The enclosed tooth remnant is removed, in addition to all teeth with pulps affected by the cystic growth. Granulation tissue is allowed to regenerate slowly within the bone cavity. In rare instances, the more

chronic dentigerous cyst may secondarily assume a tissue growth characteristic of an adamantinoma. In these cases, the operative procedure is more radical, with a less promising prognosis.

REPORT OF CASE

History.—Mrs. R. M., aged 45, white, the mother of three children, was physically active until the first symptom, headache, appeared two years before consultation at my office. The deep-seated head pains had become more frequent and severe, with a resulting loss of appetite and weight. More recently, she had been unable to work during these headache attacks and was compelled to rest for some time before resuming work. An increasing pain in a loosened tooth in the lower right jaw was the oral symptom which induced the patient to visit her dentist. Upon further examination, the dentist discovered the present lesion.

Fig. 5.—Histopathologic section; low power magnification of cyst wall.

Fig. 6.—Histopathologic section; higher power magnification of section shown in Figure 5.

Examination.—Extra-oral symptoms: Extra-oral examination revealed a pronounced barrel-shaped fulness of the entire mandible. (Fig. 1.) There was demonstrable a moderate bilateral glandular induration in the submaxillary and sublingual regions, with more pronounced symptoms of an acute adenitis on the right side. This was apparently associated with the painful and abscessed first molar. Palpation elicited some tenderness along the entire mandible, without crepitation or sharp discomfort on pressure. The sides of the face were surprisingly symmetrical.

Intra-oral symptoms: Intra-oral examination revealed a conspicuous absence of caries or any form of restoration. A localized swelling was present buccally from the lower right molar, which was very loose. The lower left cuspid was the only tooth absent in the lower jaw in addition to the upper second bicuspids. The mucous membrane of the palate, cheeks and floor of the mouth appeared normal. The gingiva showed a moderate amount of congestion. The two interesting symptoms were the pronounced buccal fulness of the mandible and the moderate movement of all lower teeth, without a response of pain on percussion and palpation. The pulp tests of the lower teeth elicited a varied response of increased sensitivity, indicating pulp changes. Nevertheless, pulp vitality was present in all teeth except the lower right first molar.

Medical History.—The patient had been treated for anemia in a hospital seven years previously and had been operated on for an abdominal condition three years previously. The jaw lesion may have contributed to the anemic condition.

The preoperative urine examination revealed no abnormal symptoms.

A blood count taken December 4, 1939, showed: hemoglobin, 83 per cent; erythrocytes, 3,760,000; leukocytes, 8,250; small lymphocytes, 29 per cent; polymorphonuclear neutrophils, 71 per cent.

X-Ray Findings.—Figure 2 shows an x-ray plate of the left mandible with the responsible unerupted cuspid within the cystic cavity. The apical involvement of the teeth is to be noted. The roentgenogram of the right mandible is shown in Figure 3. This view reveals more definitely the apical resorption of the teeth and the multilocular cystic effect of the bone cavity.

Operation.—The patient was operated on at a hospital, January 17, 1940, after biopsy to verify the clinical diagnosis. Intra-orally, vertical incisions were made bilaterally, extending from the gingival margin of the third molar downward toward the angle of the mandible. The right incision was continued along the marginal ridge to join the left side. A mucoperiosteal flap was elevated buccally to expose the thin outer plate in addition to a moderate lingual portion of the entire mandible. Owing to pulp involvement, all the lower teeth were extracted. A portion of the buccal wall was removed with rongeurs to expose the cystic sac containing a dirty brown caseated mass. The unerupted lower left cuspid found attached to the membrane was removed. This was followed by the complete enucleation of the cystic sac in three sections. The lingual plate remained in an intact condition. The soft tissue flaps were then approximated with dermal sutures. Iodoform gauze drains were inserted in the wound. Figure 4 shows a part of the bone cavity from which the unerupted cuspid was removed.

Postoperative Care.—Postoperative treatment consisted of periodic hot saline irrigations and repeated iodoform gauze dressings until granulation tissue covered the bone framework of the cavity. Slow granulation resulted in a complete and uneventful recovery. The healed alveolar ridge was narrow, but well formed for support for a denture. On the date of the last examination, October 15, 1940, the patient had no headache and had gained weight. She has since returned to her usual work.

Laboratory Examination.—A. H. Davis reported that the cyst wall measured 5 cm. in diameter and about 0.4 cm. in thickness. Figure 5 shows a low power magnification of the cyst wall, revealing a rather dense fibrous tissue lined with a perfectly orderly stratified squamous epithelium. Lymphocytes infiltrate the fibrous tissue. Figure 6 is a higher magnification of this section.

Diagnosis.—Follicular cyst of the dentigerous type involving the mandible was diagnosed.

COMMENT AND CONCLUSION

The foregoing report illustrates many symptoms characteristic of the dentigerous type of follicular cyst. This group of cysts are known to commence formation at an early age and are limitless in growth. Because of the absence of pain, they may reach an enormous size. Consequently, early and repeated routine x-ray studies of the teeth and jaws are urgent.

The term dentigerous should not be used to include every type of jaw cyst. The dentigerous cyst always has enclosed within its sac a remnant of a permanent or supernumerary tooth to which the cystic membrane is attached. Any tooth in either jaw may be involved, but this cyst is located most frequently in the cuspid and third molar areas. The clinical absence of any tooth from the normal arch of the mouth should warrant a further x-ray study, consisting of not only the usual intra-oral dental film, but also the occlusal and the 5 by 7 inch or 8 by 10 inch extra-oral film.

In extensive cystic lesions, biopsy is necessary to confirm a clinical diagnosis. Routine microscopic examination of all pathologic tissue is important for differential diagnosis and scientific study.

The oral surgeon should know the requisites of the hard and soft tissue base for the support of a prosthesis. With this in view, the surgeon should be conservative in the handling of tissues about the jaws and observe carefully the postoperative healing so as to lessen the problem for the prosthodontist.

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MANDIBULAR SUBPERIOSTEAL SWELLINGS OCCURRING IN CHILDREN

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THE Pediatric Department of Bellevue Hospital, New York City, occasionally encounters cases of unilateral swelling of the face. Such a case is usually suggestive of an acute alveolar abscess involving a mandibular tooth. As a rule, the patient is not acutely ill, and the onset, though sudden, is accompanied with but slight pain or discomfort. Cursory intra-oral examination by the pediatrician discloses no obvious source, such as a deeply carious tooth. A condition other than acute alveolar abscess is then suspected. As soon as an atypical unilateral parotitis or lymphadenopathy is excluded, the case is referred to the dental clinic for diagnosis.

As a routine in such cases, lateral and intra-oral roentgenograms are taken, and a thorough intra-oral examination is made. If they are negative, the patient is referred back to the pediatric service with the comment "swelling of non-dental origin." Up to the time this investigation was begun, the further progress and outcome of the case remained unknown to the dental service.

That such cases might be of dental origin was first brought to our attention purely by accident. The child, whose detailed case history will be given later, was a patient in the psychopathic ward. When we first had occasion to observe him, he showed a marked swelling in the submaxillary region. As his temperature was normal and he had no complaints, he was allowed to be out of bed. Though the condition had already existed for approximately a week, a complete examination, which included intra-oral and extra-oral roentgenograms, was made. The absolute lack of dental disease relegated this case to those swellings about the face which formerly had been classified as of "non-dental origin."

Other consultations necessitated frequent visits to the same ward and the progress of this particular case was therefore closely observed. The swelling was seen to decline slowly. Finally, there remained merely a small hard nodule on the inferior border of the mandible in the region just posterior to the last erupted tooth. It was more than four weeks before this slight swelling was completely absorbed. The swelling adhered firmly to the surface of the bone, suggesting a subperiosteal involvement.

Shortly afterwards, another case of the same type was referred to the clinic, and, under close observation, the condition was noted to have run precisely the same course, with the curious nodular subperiosteal swelling persisting long after the other symptoms had subsided.

At the same time that we had been observing this second case, a third case, which had completely missed our department, was being treated by surgical intervention. Despite this therapy, which consisted of incision and drainage, the third case did not differ in its clinical course from the preceding two as regards progress and outcome.

A comparison of these three cases revealed the following:

1. In all of the patients, the x-ray films revealed a normally developing molar on the affected side.

2. The swelling and eventual subperiosteal nodule were situated in the region of this developing tooth.

3. This tooth was very close to the superior border of the mandible or had erupted sufficiently that some part of the coronal portion was subgingival.

As the above-mentioned facts centered attention on the developing tooth and the area about it, it was then recalled that though the intra-oral examination was essentially negative, the tissues posterior to the last erupted tooth on the affected side did seem to be disturbed but not yet broken through by what seemed to be the pressure of the erupting tooth. The developing tooth was assumed to have provided the force, for at no time were there any signs or symptoms of an inflammatory process intra-orally in this area.

Fig. 1 (Case 1).—Right lateral jaw roentgenogram showing unerupted lower first permanent molar.

On the basis of these observations, it was decided to hospitalize all subsequent cases, in order that still closer observation could be made, and to treat them with the cooperation of the Pediatric Department as being "of dental origin." Three more such cases then presented themselves, and these, when first seen, appeared to be in a more crucial state than those we had observed previously. The therapy in Cases 4, 5 and 6 was therefore adopted primarily in an effort to avoid surgical intervention.

REPORT OF CASES

CASE 1.—S. T., a boy, aged 6, first showed a swelling February 23, 1940. It was of sudden onset, the temperature rising to 104° F. by mouth. The patient was acutely ill.

Examination revealed a marked swelling of the right submaxillary triangle extending to the submental area. The area was very firm and tender, but not hot or reddened. There was no attachment to the skin and the nodes of the neck were not enlarged. There was no respiratory distress and no inflammation about the submaxillary or sublingual ducts. The tongue was clean; the pharynx, negative.

Intra-oral examination was essentially negative except for the later noted disruption of the continuity of the postmolar gingiva. The x-ray films were negative, except for the presence of a fully formed unerupted lower right first permanent molar, which was ready for eruption. (Fig. 1.)

Fig. 2 (Case 2).—Left lateral jaw roentgenogram showing unerupted lower second permanent molar.

Ice packs were applied to the face and hot saline mouthwashes were used.

The swelling gradually subsided until, February 29, there appeared only a hard nodular subperiosteal swelling about the size of an olive in the area of the deciduous molar, involving the inferior border and extending around to the medial surface of the mandible. This persisted for more than a month, during which time it was being gradually absorbed.

CASE 2.—J. P., a boy, aged 11, first showed a swelling March 2, 1940. There was a sudden onset, with no pain in the face or teeth. When the swelling was at its height, there was slight inhibition of head movements.

There was subperiosteal swelling of bone on the left lateral surface of the body of the mandible in the region of the first permanent molar. Over it, the tissues were markedly swollen. There was no sign of inflammation. The submaxillary glands were enlarged.

Intra-oral examination was essentially negative except for the disruption of the continuity of the postmolar gingiva noted afterwards. The x-ray films were negative, except for the presence of the lower left second permanent molar, fully formed and ready for eruption. (Fig. 2.)

Ice packs and hot saline mouthwashes were employed.

The swelling subsided almost completely by March 9, with the exception of a persisting subperiosteal nodule on the lateral surface of the body of the mandible in the region of the developing tooth.

Fig. 3 (Case 3).—Left lateral jaw roentgenogram showing unerupted lower first permanent molar.

CASE 3.—A. F., a boy, aged 6, presented a swelling that first appeared March 7, 1940. There was a sudden onset with marked swelling and slight vague toothache. The temperature on admission was 103° F. by mouth.

The patient came in because of continued swelling described as involving the left lower jaw, extending from the joint, laterally to the midline, to the angle of the jaw. The area was reddened and indurated with the point of fluctuation in the center. The gums were spongy and bled easily. No gross pathologic lesions of any of the teeth were noted.

Hot flaxseed poultices were applied, and on March 14, under vinethene anesthesia, an external incision was made and pus evacuated. Swelling gradually decreased and drainage also.

The patient was discharged March 25. There was a moderate amount of purulent discharge and the tumor mass under the left ramus of the mandible continued very firm.

Roentgenographic examination revealed no deep caries or bone disease. The presence of a developing unerupted left first permanent molar was noted. (Fig. 3.)

CASE 4.—J. R., a girl, aged 17 months, admitted April 8, 1940 and discharged April 14, two weeks before had had a cold, which cleared up. Recently, the second molars had started to erupt and, according to the mother,

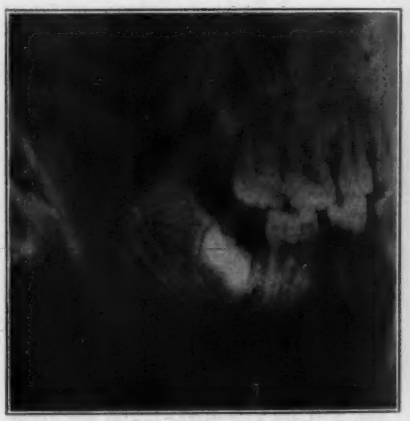

Fig. 4 (Case 5).—Left lateral jaw roentgenogram showing unerupted lower third permanent molar. The first permanent molar had been extracted several years previously.

the patient had a fever with the eruption of each one. April 2, the lower second molar began to erupt and the patient had had fever since then. Two days previously, the mother noticed a swelling at the angle of the right lower jaw, which had progressed to the present state.

Examination revealed swelling with diffuse redness and shininess of the skin from the angle of the jaw on the right side to the lower cheek and upper neck. The swelling did not pit on pressure nor did it fluctuate. Its border was not raised. There was a slightly enlarged submental node.

Intra-oral examination showed the following teeth in place: upper incisors and first molars and lower incisors, cuspids and first molars.

There was no caries. A slight disruption in the continuity of the gingiva was noted immediately posterior to the last erupted tooth on the right side.

The admission temperature was 103° F. by rectum.

Treatment in this and the subsequent cases consisted of 1.8 gm., or 30 grains, of sulfanilamide daily in six 5-grain doses. This was administered from admission until April 12, when, on withdrawal, it was found that the temperature remained down. Sulfanilamide was not administered again. The white cell count on admission was 17,400; on dismissal, 10,700.

Fig. 5 (Case 6).—Right lateral jaw roentgenogram showing unerupted lower second permanent molar.

Roentgenographic examination revealed no bone disease, but the presence of a developing, erupting lower right second deciduous molar.

The temperature was normal after the first day, the swelling becoming smaller and more localized toward the center of the jaw. There was never any fluctuation, and impending resolution was apparent.

On discharge, there was no fever. The patient was not well, but the swelling was very much smaller than on admission.

The patient was discharged one week after admission against the advice of the pediatricians, at the insistence of her parents. The first set of lateral and intra-oral roentgenograms were imperfect owing to lack of cooperation of the patient, and we were unable to see the child again to make further observations and to take more roentgenograms. However, the roentgenographic report appearing above was made from the films of the hospital. The films are not available for reproduction here.

CASE 5.—J. V., a boy, aged 12, admitted May 4, 1940, discharged May 17, had, for the past two years, had a slight toothache. Two weeks before, the toothache became worse and the father noted that the boy's face began to swell. Swelling and pain on the left side of the face had increased to date.

On admission, there was, on the left side, a large hard red swelling extending from the lobe of the ear to the symphysis mentis and the thyroid cartilage in the anterior midline. The swelling extended from a line 1 inch above the lower border of the mandible to 2 inches below it. The overlying skin was tense, red and hot. The mass was fixed to the underlying structures and immovable. It was homogeneous and no separate parts could be distinguished. It was moderately tender and there were no areas of fluctuation.

Intra-oral examination revealed little caries and all superficial. The gums were clean and showed no disease other than a disruption in the continuity of the gingiva posterior to the last erupted tooth on the left side.

Roentgenographically, there was no bone disease or evidence of abscess formation. A fully developed second permanent molar was present, giving evidence of early extraction of the first permanent molar, which allowed the posterior tooth to move into its position. Distally, there was a developing unerupted third permanent molar. (Fig. 4.)

The temperature at admission was 102° F. by rectum.

Sulfanilamide, as described above, was administered from admission to May 15. The temperature fell to normal within two days and remained normal thereafter. The swelling of the face gradually receded.

The patient was kept under observation for six weeks after discharge, during which

time the hard nodular subperiosteal swelling in the region of the unerupted tooth on the left side very gradually subsided.

CASE 6.—A. S., a boy, aged 8, admitted June 1, discharged June 19, had had an increasing swelling under the right mandible for five days, with no pain or fever present. There was no toothache except for a slight pain two weeks previously.

On admission, there was a rather tender firm indurated mass on the right side of the face just forward from the angle of the mandible and extending to within 3 cm. from the point of the chin. The induration extended up over the mandible to about 3 cm. below. There was slight redness.

The mouth was clean, with a few amalgam fillings and a few cavities, none of them deep. Posterior to the last erupted tooth on the right side, there was no break in the gingiva, but the tissues had been displaced upward.

Roentgenographically, the teeth and bone showed no disease, but there was a developing second permanent molar on the right side. (Fig. 5.)

Sulfanilamide was administered as above from the day of admission until June 18. Therapy was maintained long after the massive swelling had disappeared. The typical nodular subperiosteal swelling persisted and its absorption did not seem in any way to be hastened by continuance of the sulfanilamide therapy. There was no fever at any time.

The patient responded well to the sulfanilamide. The swelling was gradually absorbed and on discharge the patient was improved.

Six cases have been presented. They are similar as to onset, external appearance, intra-oral appearance, roentgenographic findings and course. Five of these cases were observed to completion and presented precisely the same course of recovery.

Our observations have been inadequate to attempt to describe the pathologic processes which produced a cellulitis of the tissues of the face and a subperiosteal involvement of the mandible. However, our observations enable us to formulate a theory regarding the cause of these pathologic processes.

In all six cases, an erupting developing tooth was found close to or through the periosteum of the bone distally from the last erupted tooth. Intra-orally, this was evidenced in all cases by an actual raising of the mucous membrane or gingiva in this region. In no case was there a break in this tissue, or any of the typical intra-oral symptoms or indications that would allow a possible diagnosis of pericoronitis. Therefore, we believe that the disruption of this tissue disturbed the gingival trough or crevice along the distal surface of the last erupted tooth sufficiently to allow the passage of normally present organisms into the submucous and subperiosteal structures of the mandible. The organisms were thus introduced into tissues where a natural immunity or resistance to infection did not exist, with the above-described results.

It may be repeated that we have attempted to formulate a theory as to the mode of entry of organisms from the mouth to deeper structures, as well as the forces which established this avenue.

CONCLUSION

1. Three cases involving a unilateral swelling about the mandible were observed. Acute alveolar abscess as a diagnosis had been eliminated for lack of an abscessed tooth.

2. Several facts were common to all cases. Namely, a normally developing, unerupted molar was situated on the side and near the swelling. The developing tooth was near or through the superior border of the mandible and, after the process was averted and the swelling had subsided, a small subperiosteal nodule persisted. Furthermore, it was recalled that, intra-orally, the gingival tissues about this developing molar had in all instances appeared raised or disrupted.

3. Three more cases observed also presented the above-described findings.

4. The subperiosteal swelling was attributed to the fact that the developing tooth disturbed the overlying tissues sufficiently to allow an avenue for infection in the gingival crevice distally from the last erupted tooth.

In order to determine whether this condition had ever before been recognized and an explanation attempted, a thorough search was made of pediatric texts and dental literature. No case or condition was found whose history appeared similar to those histories presented above.

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APPLICATION OF BASIC SCIENCES TO GOLD INLAY FABRICATION

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STATED in general terms, the subject "Application of Basic Sciences to Gold Inlay Fabrication" is an extensive one. A deliberate effort has been made to make the statement general, however, so that the conclusions may be free of prejudice or bias for any particular technic. Applying certain recognized scientific procedures to the analysis of gold inlay fabrication, we should desire freedom in reaching our conclusions, a perspective which encompasses all manner of gold inlay fabrication, perusal of all verifiable fact pertaining to the subject and application of basic sciences to recorded fact wherever possible, for thus we reduce empiricism to the status of an exact science, conditioning all the preceding by clinical study and verification.

In a broad approach to the subject, one must take cognizance of two general types of inlay fabrication, the direct and the indirect technic. Adherents of either technic passionately insist that they each in turn are making the superior filling. Time and scientific advance do not erase or mitigate this conflict of opinion. The impassioned conviction of an adherent of a direct or an indirect technic can be likened only to a religion. Similarly, the superiority of either technic as a whole, like religion, may not even be a moot question. If we set aside the general premise on which there is wide disagreement, and study certain steps or phases of our work in both processes, we may all profit.

What is it that we seek in inlay procedures? Is it accuracy? Accuracy as an end-result is determined much more by the operator's diligence, his personal ability, his philosophy of operating and the patient's behavior than by the choice of accepted mechanical procedures. While the foregoing are probably the vital factors in the accuracy of our results, it cannot be denied that there are certain advantages or disadvantages to both technics.

In the discussion, the direct technic will be taken to mean only those methods by which the actual carving of the pattern is done on the tooth in the mouth. It shall be assumed that the force of occlusion was utilized in the adaptation of the wax, that the pattern was immobilized during the carving and that it was not removed from the tooth until the carving was complete. Strictly speaking, the direct technic employs no intermediary die or die-form.

The indirect technic as here held

forth is one that limits itself to a two-surface restoration as nearly as circumstances will permit. In its ideal application, the accuracy of this technic is considerably improved when so limited.

Every operator soon realizes that all technics exhibit certain advantages and certain distinct disadvantages. These advantages and disadvantages need not apply indiscriminately or with equal force for every particular case. Thus, in the back of the mouth, the direct technic is likely to be less desirable and less accurate than the indirect; not because of any fundamental inferiority of the former, but because the inaccessibility, the presence of saliva or blood, obstruction from the tongue, cheek or adjacent teeth and, if the mirror is used for vision, the optical parallax play a discouraging part; whereas, in the anterior, bicuspid or even the first molar region, these elements are inconsequential. It is relatively easy to get a good direct pattern of a lingual dovetail inlay, and relatively hard to get a good impression by the indirect method. It would seem advisable, therefore, to take a lingual dovetail pattern by the direct, an impression of a typical cavity in a second molar by the indirect, method.

An analysis of inlay procedures by the direct and indirect technics should begin with cavity preparation, which is fundamentally different for the two types of inlay procedure, and in itself presents certain advantages and disadvantages. Generally speaking, Black's box-type cavity preparation should be used for direct work because bulk is needed in the wax pattern. Thin cavity slices are fins of wax in the pattern, and fins of wax are hard to manage by direct carving. There is a tendency to pull them off during carving since the margins of the slice and the wide bevel are hard to differentiate in the mouth. The box preparation is an advantage in the front of the mouth, particularly on the mesial aspect of upper teeth, because one can satisfy the rule of extension for prevention and still not expose an objectional gold margin. For indirect work, the slice preparation is the cavity form of choice.

Nomenclature regards a tooth as a barrel-shaped cube. That being the case, when one contemplates its external surface, a tooth presents three undercuts, where a mesioclusal or distoclusal preparation has been made in a posterior tooth. These anatomic undercuts are those produced by the buccal and lingual convexities and, at right angles to these, the mesial or distal convexities. There are six such anatomic undercuts for a mesioclusodistal inlay. If the indirect cavity is prepared according to surgical principles and is well beneath the contact point, and if the cavity is completely delineated in the impression, the latter engages all of these undercuts. Keeping in mind the impression materials commonly used for this purpose, this is tantamount to stating that an accurate indirect impression is a virtual impossibility.

Theoretically, while it would seem impossible to dislodge an indirect impression without distortion, clinically, of course, excellent results are demonstrable using the indirect system. How shall we explain this disparity? I believe that two phenomena occurring simultaneously make possible this paradox. One of these is the fact that it is impossible to obtain absolute or perfect adaptation of the impression material to the cavity wall. This permits of little freedom or tipping, which is adequate to dislodge the impression when one deals with cone-shaped surfaces of a shallowness prescribed by the exponents of the technic. The other is a certain definite, though small, modulus of elasticity possessed by the compound and retaining band. If the impression with its band is not strained beyond the elastic limit, an accurate impression is possible. If the impression and band are strained beyond the elastic

limit, permanent deformation occurs. Most inaccurate castings result from this and not from subsequent conditions.

Research investigators have endeavored to select materials for indirect inlay impressions with a high modulus of elasticity. The objection to them lies in the rather extreme manipulative procedures necessitated by their use, and the need for oversized retaining bands to permit the material to assert its flexing qualities. Kyprie points out that the more successful of these materials possess very high viscosity and will not flow into intimate contact with all the cavity surfaces. Too frequently, failure occurs at the gingival surface. It is unfortunate that a properly festooned band affords the least support to an impression material at the gingival juncture. Often, the band will be displaced mesially or distally or both at the gingival portion, and the impression material and band will be wedged under the contact points of the adjacent teeth. If wooden wedges are used interproximally to forestall this eventuality, the elastic qualities of the material are constrained, and elastic strain may be imparted to the band. The proximity of the adjacent tooth often allows for only a thin layer of impression material between the band and the cavity surface. Wax, dental compound and the colloid impression materials are the only substances available today with sufficient flowing qualities to respond successfully to the limitations imposed by the conditions. The colloid materials cannot be electroplated. Wax becomes distorted easily, shrinks excessively, drags and will not clearly delineate the cavity margins. Dental compound is still the impression material of choice.

The probability of getting an accurate two-surface indirect impression is much greater than that of getting an accurate mesioclusodistal impression. The fact that the impression is not in absolute contact with the cavity surface will serve the operator in good stead in dislodging a two-surface indirect impression because, if traction is exerted in a manner to move the cervical portion away from the tooth simultaneously with a movement to carry the impression out of the cavity, the modulus of elasticity will, in almost every case, permit an undistorted impression. Traction to remove a mesioclusodistal impression must be straight down or up, depending on whether the impression is an upper or a lower. As a rotational movement cannot be employed in displacing a mesioclusodistal impression, complete reliance must be placed upon the modulus of elasticity in the impression system to obviate distortion. Experience bears out the fact that it is much more difficult to obtain an accurate mesioclusodistal than a two-surface impression. Certainly, one encounters more than twice the difficulty.

A two-surface impression can be best secured by placing a properly festooned band over the prepared tooth, placing a loosely fitting interproximal wedge between the band and the adjacent tooth to prevent gingival displacement and pressing a softened compound cone into the band while in position.

The mesioclusodistal impression is best secured by expanding an undersized band in order that the shoulder of the expanded band may engage the occlusal contour of the prepared tooth, thus preventing excessive apical movement of the band. The band is festooned. The impression material should be luted to the band and carried in the band to the tooth, and the band pressed to position until the shoulder engages the tooth. The impression is chilled, and removed without tipping, and band and compound are trimmed back to the margins of the cavity borders where these extend too far into the anatomic undercuts. This impression is now replaced on the tooth, and wooden wedges are loosely placed in the interproximal spaces to furnish support against mesial or distal displacement of the axial band surfaces. The impres-

sion is corrected by irrigation with water warm enough to reactivate the flow of the compound. Pressure is exerted apically on the band, until the compound just begins to exude. The impression is chilled and carefully removed without tipping. If the impression does not come away easily, the process will have to be repeated until it does, as otherwise the impression is quite apt to be distorted.

Great pains should be taken to use bands that tightly hug the prepared tooth along the margins of the cavity. Not only is the snug fitting band an insurance against overextension of the compound into an anatomic undercut, but also the quantity of compound between the band and the cavity will be reduced to a minimum. The thinner the layer of compound recording the slice flanges, the less restriction it offers to the play of the modulus of elasticity contained in the retaining band, which is much greater, and therefore more important to preserve, than that possessed by the compound.

It is possible to arrive at a mathematical statement of the severity of the task in obtaining an accurate mesioclusodistal as compared with a mesioclusal or distoclusal impression. The application of mathematics to a given problem is the most powerful tool at our disposal. Using our model of a barrel-shaped cube, we recall that the buccal and lingual convexities of a two-surface cavity each act to produce an anatomic undercut, and that the mesial or distal convexity also acts to produce an undercut in a plane perpendicular to the preceding two. It is conceivable that, in taking an external as well as internal impression of such a cavity, the impression material can flow into one, two or all three undercuts to such an extent that, in retracting the impression, one, two or all three may be operating to cause a permanent deformation. Several possibilities of introducing distortion creep in. We may have the impression material stopping just at the margins of the cavity or just sufficiently beyond to delineate the cavity and not be of an order to strain the elastic limit to the point of permanent deformation; or all impression margins may be favorably disposed but one, which may overextend into an anatomic undercut and thereby be responsible for a permanent deformation in the retraction of the impression.

If we regard each anatomic undercut separately, three such possibilities exist. Pursuing this analysis farther by the mathematics of permutations and combinations, we may have two such overextensions into anatomic undercuts acting together, and there are three such possible pairs. Then we may regard the situation where overextension of impression compound has occurred into all three and obtain still another possibility of introducing distortion. Thus, $3 + 3 + 1 = 7$ possible sources of distortion for a mesioclusal or distoclusal impression. Now, for a mesioclusodistal impression we have six anatomic undercuts to consider. For purposes of simplification, let us denote each overextension of impression material into a given undercut as acting to produce distortion at some point or locus on the periphery of the overextended mass. We shall name these loci A, B, C, D, E and F. (Fig. 1.)

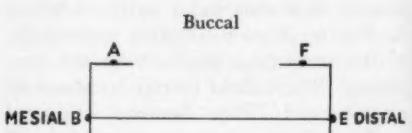

Fig. 1.—The six anatomic undercuts.

In addition to the seven possible sources of distortion for each face, that is the mesial and distal surface, of the mesioclusodistal impression, acting individually, we have, for each single locus

on the mesial face of the mesioclusodistal impression, three individual loci on the distal face. We may say, for instance, that A can act separately against D, E or F to produce distortion, and B can act against D, E or F, and C can act against D, E or F; or $3 \times 3 = 9$. A can also act against DE, EF or DF as pairs to produce distortion, and so can B and C; or $3 \times 3 = 9$ again. A, B and C can act against all three loci D, E and F acting together, or $3 \times 1 = 3$. Thus, $9 + 9 + 3 = 21$ possible sources of distortion when we consider loci A, B and C individually. A, B and C may also act in pairs against D, E and F individually, or $3 \times 3 = 9$; D, E and F in pairs, $3 \times 3 = 9$, and D, E and F together, $3 \times 1 = 3$. Thus, $9 + 9 + 3 = 21$. Finally, A, B and C may act together against D, E and F individually $1 \times 3 = 3$; D, E and F as pairs ($1 \times 3 = 3$), and D, E and F together ($1 \times 1 = 1$). Thus, $3 + 3 + 1 = 7$. All possibilities exhausted, this yields the surprising total of $7 + 7 + 21 + 21 + 7 = 63$ possible sources of distortion for a mesioclusodistal impression as compared with seven for a mesioclusal or distoclusal impression where all other factors remain constant and equal. Large though the disparity may loom between the possible accuracy of a three-surface as compared with a two-surface impression, actually it is even greater because the two-surface impression does lend itself to a tipping or rotational retraction, which greatly augments the opportunity of getting an undistorted impression.

Our mathematical findings state the case of the indirect inlay at its worst. Clinically, assuming that care is exercised in operative procedures, a distorted casting is rather uncommon. A number of factors come into play which mitigate the apparent hopelessness of the mathematical analysis. By far the most important, considering the foregoing, is a resolution of the problem by mechanics. We must reduce the anatomic undercuts of the inlay preparation by slicing to such an extent that we approach the limits imposed by the physical properties of the impression materials. For the typical indirect inlay, the operator must excavate caries, fill the gross cavity with cement and then proceed with the cavity preparation, cutting shallower and broader than for Black's box-type preparation. Therefore, the direct worker's observation with respect to the indirect inlay as "an island of gold on a sea of cement." The occlusal dovetail should be less T-shaped. Adequate retention will be obtained despite the shallower cutting because the slice provides a very broad cement-surface contact with the tooth. Physiologically, the shallower the preparation, the more desirable. The shallowness of cutting should not be of an order, however, to effect any untoward compromise with the mechanics of retention.

The acceptance of harder inlay golds as good operative procedure must be coincident with the acceptance of the indirect technic. Harder inlay golds are an absolute essential to the success of restorations incorporating thin slices. The softer inlay golds, such as 22K, will not resist deformation by masticatory and attritional stress where thin slices of tooth are restored and mechanical retention is relatively shallow. It is particularly inadvisable to use soft gold where such inlays serve as bridge abutments. A gold with a Brinell hardness of about 90 works very well for indirect work. This gold has adequate burnishability, and proves substantial under masticatory function.

Another aspect to consider from the standpoint of advantage and disadvantage is the transfer of cavity dimension to casting dimension. It seems axiomatic that the fewer the intermediary steps, the more desirable the technic. The direct inlay technic employs two intermediary steps, the impression (wax pattern) and the mold. The indirect inlay

technic employs four, impression, die, pattern and mold. Scientifically, it would not be accurate to say that, therefore, the hazards of discrepancy are twice as great for the indirect inlay as for the direct inlay. The hazards might conceivably mount as a geometric progression or, on the other hand, they might be no greater than in the case of the direct inlay.

We know that the volumetric change from mouth temperature to room temperature is considerably greater for wax than for dental compound. With the advent of the electroforming process, the conversion of the impression to the die can be accomplished with no appreciable discrepancy. The question might well be raised whether it is possible to adapt wax as intimately to the cavity walls of the die as to the cavity walls of the tooth itself. Where the force of occlusion is utilized in adapting the wax to the cavity, a hydraulic pressure of from 150 to 300 pounds per square inch is exerted on the wax against a form (tooth) that presents a warm surface to the wax, and enables wax to flow to the fullest advantage. Adaptation of the wax to the die is accomplished under finger pressure (8, 10 or perhaps 18 pounds per square inch pressure) against a die that normally is used at room temperature. The coldness of the die acts to produce a "skin" over the softened inlay wax, which resists accurate adaptation with the softer wax behind it. When a confining band is applied to the die and the wax is melted directly into the cavity, heat is transmitted to the die, and the discrepancy from this source is reduced to a minimum.

Before dismissing the question of adaptation, it might be well to consider just how accurate an adaptation is desired. Is it necessary or even desirable to strive for the adaptation of a direct inlay? The greater the accuracy of adaptation, the greater the likelihood of thermal shock to the dental pulp because the insulating bed of cement is necessarily thinner. Whatever the limitations or merit of the internal fit of the indirect inlay may be, the marginal fit should approach perfection. Marginal perfection can be approached by remelting the wax along the margins of the cavity with a hot wax carver, a small segment at a time, and readapting them under finger pressure. These margins should be thickened slightly. In dentistry, as in industry, casting to dimension is impracticable if not impossible. To take a tip from industry: Casting oversize and then grinding to dimension is not only feasible, but also highly desirable.

It is with a great deal of compunction that I venture upon the next phase of our work. Volumes have been written on investing and casting procedure. In a dissertation of this nature, it is necessary to consider this aspect of the problem in that the investing and casting procedures may be somewhat different for the two inlay technics, and something more of value may be found in the one as compared with the other.

As the direct pattern is bulky and more nearly approaches a sphere in form (intracoronal), mold expansion compensates more exactly for casting shrinkage. However, inlay wax shrinks more than dental compound when reduced from mouth temperature to room temperature, and the bulkier the pattern, the greater the demand for expansion of the mold, to compensate for gold shrinkage. The two preceding factors operate toward the same end; that is, to require extreme expansion for casting compensation. Full advantage should be taken of setting, thermal and possibly also hygroscopic expansion. The placing of a loose asbestos liner in the inlay ring probably permits unrestricted, three-dimensional expansion. Excessive wetting of the liner should be avoided unless recourse to considerable hygroscopic expansion is sought as a compensatory mechanism.

For the average indirect mesiocluso-

distal two-surface inlay or thin three-quarter crown, we want considerably less expansion than we would desire for the average direct pattern. One of the acceptable "all-purpose" investments employing a dusting technic as outlined further along in this article works peculiarly well. The investments commonly used for one-piece castings combine a certain ruggedness and simplicity in manipulation with constancy of reliable performance, which recommends them strongly. Gold thimbles and jackets with straight axial walls require considerably more expansion than the preceding technic will afford. An investment with the expansion of crystobalite, when used with a loose asbestos liner, seems to be necessary for adequate expansion of the latter.

It should not be construed that the following investing rationale will yield a product superior to that obtained by the more complex procedures described by Scheu, Phillips and others. However, it will yield a product of comparable worth. Nor should it be inferred that issue is being taken with the results of Nelson's investigation. From a practical standpoint, at least for indirect work, the conditions set forth in the preceding paragraph are essentially true. Experiment reveals as a fact that when compensation is inaccurate for an inlay combining the intracoronal and extracoronal features, there is an obvious discrepancy at the gingival aspect. In the overexpanded form, the casting will be loose and the gingival flange will stand away from the die. In the underexpanded form, the casting will be tight, and if the gingival border is a butt joint, almost invariably an open margin is demonstrable along the gingival juncture. For these reasons, we desire a reduced, but controlled expansion. We want restricted expansion of the occlusal portion of the inlay, which will operate to hold the axial portion tightly against the die. On the other hand, we want axial expansion in order that the gingival discrepancy may be prevented. These conditions can simultaneously be achieved if: (1) the pattern is mounted on the sprue at the mesial or distal marginal ridge with the occlusal perpendicular to the axis of the sprue, and (2) no asbestos liner is used. Hygroscopic expansion should be completely ruled out if possible.

This is challenging an axiom in a sense, and an explanation should probably be forthcoming. The method suggested above may be regarded as pseudoscientific in that, by confining the expanded investment in a ring whose expansion is less than that of the investment, a linear component is introduced into a volumetric expansion, and, to some extent, distortion of the mold does occur. The crux of the whole matter resides in this: that the castings will be found to fit more accurately where this principle is employed than where it is not employed. In other words, this volumetric distortion of the mold operates to our advantage, and does not introduce any other new problems or appreciable inaccuracies in the castings.

A brief description of the investing technic might be in order. After the pattern is mounted on the sprue and sprue-gate former in the manner suggested above, the pattern is washed with green soap, rinsed in room temperature water and thoroughly dried with a chip blower. The investment is mixed according to specifications and spatulated by a mechanical spatulator. The pattern is carefully painted with a small soft brush, vibrated by the rubbing of a knurled instrument along an edge of the sprue-gate former. Excess investment is blown off the pattern by use of the chip-blower, until the pattern is completely covered and free of any minute trapped air or water pockets. Enough investment is applied over the pattern to cover all of it to a depth of 2 mm. Margins must not protrude through the investment.

With a large camel's hair brush, dry investment is dusted onto the covered pattern, and the sprue-gate former is vibrated by the rubbing of a knurled instrument over an edge. This process is continued until the water in the investment on the pattern will not take up any further dry investment. By this time, the investment in the bowl should begin to show signs of setting. The next step is not taken until it does. This is a precautionary measure to reduce hygroscopic expansion as much as possible because the remaining investment in the bowl will be used as a matrix to hold the dense core in the inlay ring. When the bowl investment shows signs of setting, the inlay ring is placed around the core, and the investment is teased from the bowl into the ring. The foregoing method will consistently give excellent, smooth, accurate castings which will not require swaging.

RECAPITULATION AND ADDENDA

Direct Technic

Advantages:

1. The box-type cavity affords extension for prevention without objectional gold margins.
2. There is no distortion of the inlay impression.
3. There is positive adaptation, with from 150 to 300 pounds pressure as compared with 8, 10 or 18 pounds finger pressure.
4. Very little laboratory time or work is required.
5. Mesioclusodistal inlays can be made with as much accuracy as a two-surface inlay.
6. There is a minimum of chair adjusting required after casting.
7. The pattern is easily obtained where access is good and, in many cases, where indirect impressions are most difficult, as in lingual dovetail inlays.

Disadvantages:

1. It is more difficult to restore anatomic form and proper occlusion, particularly in malposed or tipped teeth. Occlusion from the lingual aspect cannot be seen.
2. There is no die. Polishing of the filling must be done in the mouth on the tooth. Consequently, it is very difficult to polish bridge abutments.
3. It is difficult to carve patterns with thin wax fins. Direct carving of slice preparation is almost impossible.
4. Wax cannot be added to the pattern with any degree of success, especially at the cervical portion.
5. Contacts must be soldered.
6. Unless patterns are immobilized during carving, movement of the pattern in the cavity will produce distortion or inaccuracy. It is extremely difficult to immobilize patterns in the cavity of a tooth having no proximal tooth, as in preparation for bridge abutments or a distoclusal cavity in a second molar where the third is missing.
7. Large patterns in the back of the mouth, particularly lower, are difficult to carve because of interference of tongue, cheek, saliva, blood, adjacent teeth and optical parallax.

Direct-Indirect Technic

The direct-indirect technic is devised to obviate difficulties encountered above. This method uses a die-form of stone or investment.

Advantages:

1. Wax can be added for contour and contact.
2. The anatomic form of the filling can be more successfully worked out.
3. Peripheral seal of margins is afforded.

Disadvantages:

1. The same distortions in removing the impression may occur in this technic as in the indirect.
2. There is no substantial die to support the filling in grinding or polishing operations.

3. There is no occlusion on an articulator to make corrections for crown height and lingual occlusion.

Indirect Technic

Advantages:

1. There is a more nearly peripheral preparation, affording thinner, shallower inlays, and less thermal shock.

2. A die is especially valuable for bridge construction.

3. With slice preparation and proper cavity form, when limited to two-surface castings as much as possible, it yields a precision fit.

4. The same precision fit can be obtained in positions of difficult access, and where visibility is poor.

5. The die on the articulator affords an accurate reconstruction of lost vertical crown height and lingual occlusion.

6. There is a minimum sacrifice of tooth structure.

7. Fillings can be polished on a bench lathe in a fraction of the time required in the mouth.

8. In case of casting failure, there is no embarrassment through recall of the patient.

9. Mastery of the indirect impression technic makes the operator more proficient in other forms of operative dentistry: porcelain jacket impressions, porcelain inlay impressions and, now, plastics.

10. Peripheral, but not internal, fit can be made more accurate than by the direct technic, for a number of reasons amplified earlier, but primarily because it is impossible to cast to dimension, but one can cast oversize and grind to dimension.

11. Less chair time is required (?).

Disadvantages:

1. There is a possibility of distortion (especially true of mesioclusodistal impressions).

2. More laboratory work or laboratory expense is called for.

3. There is a greater display of gold.

4. The use of the indirect technic results in hard gold restorations all around the mouth. Some operators question the advisability of restoring a mouth with a gold having a Brinell hardness number greater than 50.

5. Indirect inlays require more adjusting, greater skill and a clearer understanding of the influence of occlusion on possible periodontal damage, for proper adjustment of occlusion.

6. The internal adaptation of the indirect inlay to cavity walls is not so close as that of a direct inlay. Gross adjustments of margins should never be attempted after cementation.

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CONSERVATIVE TREATMENT OF PULPLESS TEETH

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THE method of treating pulpless teeth to be presented here is neither new nor revolutionary. If it were new, it would be untried by time; and if it were revolutionary, it would warrant suspicion. In fact, the method to be described here may not differ materially from everyday methods of practice, except in certain details. But details are important, particularly in root-canal treatment. Whatever additional merit this presentation may have lies in interpreting the pulpless tooth in its relationship to systemic disease.

WHY TREAT PULPLESS TEETH?

Before we discuss how to treat pulpless teeth, we might ask ourselves the question: why treat pulpless teeth? Why indeed make an attempt at saving a pulpless tooth when it is simpler to extract it? Once extracted, "dead" teeth, like dead men, tell no tales.

It is not only simpler to extract than to treat pulpless teeth: it is also less exacting to both patient and dentist. It requires a great deal of technical skill—surgery of the most delicate sort—to treat pulpless teeth successfully. It often takes excellent judgment, care and ingenuity to carry a root-canal operation through to a successful conclusion. It may become a challenge to one's patience as well as one's skill to enter a narrow root canal and widen it so as to gain access to the periapical tissue. Why worry oneself over such delicate operative procedures when slight leverage from a pair of forceps can relieve one of the tedium and responsibility of trying to save a pulpless tooth?

It is not only simpler and less exacting to extract than to treat pulpless teeth: it is also less time consuming. Root-canal treatment takes up a great deal of the dentist's time. Why dilly dally with a pulpless tooth when with the administration of an anesthetic and the application of forceps, the tooth is out, the trouble over!

It is not only simpler, less exacting and less time consuming: it is also more economical for the patient to have the tooth out rather than have it treated. At least, it is more economical for the time being.

Then, too, pulpless teeth are a menace to health. They can give one neuritis, arthritis, nephritis, myositis, bursitis, colitis, endocarditis and several other kinds of itis. Not all at one time, of course.

PULPLESS TEETH AND FOCAL INFECTION

Being practitioners of the healing art, we may set aside the objections of complexity, economy, time and skill. Not that they are unimportant in the social scheme of things, but they are secondary to the prime consideration—the patient's health. Dentistry is not a trade and we are not members of a guild, working only to earn a living. We are interested in the patient's health, to which normal masticatory function contributes. Without doubt, the question "Why treat pulpless teeth?" centers in whether a pulpless tooth is a menace to health.

Read before the Odontological Society of Western Pennsylvania, November 20, 1940.

Fifty years ago, this question would not have arisen. Dentists of that period were concerned with saving as many teeth as possible. The causal relationship of infected pulpless teeth to systemic disease would probably then have been denied.

Twenty years ago, the tables were turned and almost every pulpless tooth was accused of being an actual or potential menace to health. Some physicians and dentists would not tolerate pulpless teeth under any circumstances regardless of the condition of the periapical tissue. The pendulum had swung from extreme conservatism to extreme radicalism.

Now, what is the relationship between pulpless teeth and focal infection? Are we to imply that all pulpless teeth are dangerous to health, or are we to believe that all pulpless teeth can be safely retained? The answer is: Neither. There is danger in extremes of whatever nature and this is no exception. It is just as irrational to condemn all pulpless teeth as it is to save them. It is just as irrational to treat all pulpless teeth as it is to extract them. Somewhere between the two lie good judgment and safety.

There is no doubt that infected pulpless teeth can cause disease elsewhere in the body. We have only to think of the systemic reaction associated with an acute abscess to realize that the possibility exists. We have only to think of those fortunately rare cases of bacterial endocarditis following extraction to realize that such relationship does occur. We have only to recall that transient bacteremia may occur during or shortly after extraction of teeth. Metastatic reactions of this type—dissemination of infective agents from a focus of infection, whether from tooth, tonsil or other organ, can and do occur. The point is that they probably occur far less often than was once thought. To accept the focal infection theory as proved fact, operative in every case where foci of infection are present, is unwarranted. I am of the opinion that, under certain circumstances, pulpless teeth can be treated and retained in normal oral function without affecting the health of the patient. The reasons for this opinion have been set forth in a previous paper.[1]

The conditions that make for a favorable end-result in the treatment of pulpless teeth are: (1) careful selection of cases for treatment, each case being evaluated on both a local and a systemic basis; (2) strict adherence to principles of asepsis and antisepsis during root-canal treatment, and (3) the obtaining of a negative culture before the root canal is filled; or, if a negative culture is not obtained, the combining of root-canal treatment with root amputation.

In addition, follow-up x-ray pictures should be taken over a period of years to determine whether the condition of the periapical tissue is one of *status quo*, improvement or retrogression.

SELECTION OF PULPLESS TEETH FOR ROOT-CANAL WORK

Careful selection of pulpless teeth for root-canal treatment is imperative if one is to avoid ultimate failure. Pulpless teeth should not be treated in older patients and in those in poor health, with definitely known diseases, such as syphilis, tuberculosis, diabetes and anemia, except when these conditions have been brought under control. Pulpless teeth are preferably not treated when a serious disease in which a focal infection relationship is suspected, e.g., iritis or cardiovascular or renal disease, is present. Pulpless teeth should not be treated when any of the following local conditions are present:

1. The canals are not patent and access to the periapical tissues of x-ray positive teeth is not attainable.

2. The area of rarefaction involves

the entire apical third of the tooth.

3. There is a definite crater-shaped erosion of the root apex, indicating destruction of apical cementum.

4. A radicular cyst is present.

5. The periapical pathologic area communicates with the gingival sulcus through a fistulous tract.

6. Accidental or pathologic perforation is present.

7. The tooth is so badly damaged that an aseptic technic cannot be carried out.

8. Alveolar resorption is extensive, involving one-half of the root.

9. There is a history of unfavorable response to previous root-canal work.

10. Five or six pulpless teeth are already present.

Other conditions may suggest themselves in deciding whether treatment should be carried out in a given case.

ROOT-CANAL PROCEDURE

The technic of root canal treatment should be so planned that principles of asepsis and antisepsis are complied with. Asepsis, denoting absence of germs, should be descriptive of the state of every instrument used on or in the tooth under treatment, and of the field of operation. Long-handled instruments should be sterilized in boiling water for at least ten minutes, or else should be autoclaved. Burs are also preferably sterilized by boiling, although immersion in molten metal for twenty seconds may be adequate. All instruments may be resterilized during the course of the operation by dipping in alcohol and flaming twice. Instruments to be used in the root canal itself may be sterilized by being placed in a molten metal sterilizer and allowed to remain for five seconds. Pledgets of cotton and absorbent points may be sterilized in the same manner for ten seconds. This type of sterilizer is absolutely indispensable for preserving the chain of asepsis in root-canal work. The field of operation may be sterilized by cleaning the teeth, then scrubbing them and the adjacent rubber dam with a large wad of cotton saturated with untinted tincture of metaphen. This leaves an unstained, sterile operative field.

PREPARATION OF THE ROOT CANAL

Preparation of the root canal means the removal of necrotic pulp tissue and organic débris, gaining access through the apical foramen to the periapical tissue and widening the root canal so that eventually it may be filled without difficulty.

The preparation of the canal actually begins with proper access to the pulp chamber. In anterior teeth, this is preferably accomplished by way of the cingulum. Where a filling is already present, a mesial or distal approach is sometimes also satisfactory. Generally, however, this means cutting away much of the gingival floor and widening the cavity for direct access so that, in the end, as much tooth structure is removed as by the lingual approach. In posterior teeth, the approach should be preferably from the mesioclusal or else the occlusal aspect. In premolar teeth, an occlusal approach may be sufficient if the prepared cavity is large enough to uncover the canal openings. It is important to widen the approach labiolingually in upper premolar teeth to reach both canals. In molars, a mesioclusal approach is preferable to an occlusal approach because the openings to the fine mesial canals often begin close to the mesial wall. In opening into the pulp chamber of a lower molar, it is recommended that the bur be directed toward the distal canal, and in an upper molar toward the palatal canal; in other words, toward the larger canal. The bur head will then slip into the pulp chamber toward the canal orifice without difficulty. With this as a guide, the roof of the pulp chamber can be removed more easily and the other canals be exposed. If it is difficult to identify the canal orifice, tincture of iodine can be applied

to the floor of the pulp chamber and can then be decolorized with alcohol. The opening leading to the canal will take the stain better than the surrounding dentin, and this will reveal the entrance to the canal as a dark spot.

To continue preparation of the root canal itself, both mechanical and chemical means may be employed. Mechanical means consist of the use of broaches for removing pulp tissue and dentinal débris; reamers for gaining access through the apical foramen and for widening the canal, and files for planing and enlarging the canal. The following rules should be observed:

1. Direct access should be obtained along straight lines.
2. Smooth instruments should precede barbed or rough instruments.
3. Narrow instruments should precede wide ones.
4. Reamers should not be given more than a quarter turn at a time.
5. Reamers should precede files.
6. Files should be used with a pull stroke.
7. No root-canal instrument should be forced when it binds.
8. Short-handled instruments should preferably be used in posterior teeth.
9. Root-canal picks should not be used past the apical foramen.
10. Débris should not be forced beyond the apex.
11. Apical tissue should not be traumatized.

Chemical agents are used for disintegrating and liquefying pulp tissue, and for disorganizing and dissolving dentin in order to cleanse the canal, eliminate obstructions and assist instruments in enlarging the canal. For this purpose, I prefer sodium-potassium alloy or 30 per cent hydrochloric acid, generally the former. Sodium-potassium alloy is a highly active chemical agent having a powerful affinity for moisture. In contact with moisture, the hydroxides of sodium and potassium are liberated with the evolution of hydrogen. The reaction is often violent enough to ignite the hydrogen, ignition being seen as a momentary flash in the root canal, resulting in incineration of the pulpal débris. Only enough of the sodium-potassium alloy to adhere to a smooth broach should be used in the root canal. Sodium-potassium alloy should not be forced beyond the root apex because of its highly destructive effect. It should not be used in teeth with wide open foramina. It is not so effective when used in a dry canal because the moisture present is insufficient for a reaction. In addition to destroying pulp remnants, sodium-potassium acts upon and dissolves the organic portion of the dentin, leaving a friable, inorganic framework, which is more readily cut away with files or reamers; and therein lies its value for enlarging root canals.

If the canal is dry or, for other reasons, an acid is desired for overcoming obstructions or enlarging root canals, 30 per cent hydrochloric acid may be used. This acts upon the inorganic content of dentin, dissolving it, and so preparing the root canal for easier cutting by means of instruments. Since hydrochloric acid does not act at once, but slowly, it is best to let it remain undisturbed in the canal for five minutes, then dry the canal and cut away the friable material with files or reamers. This process may be repeated several times if necessary, or until the canal has been made sufficiently wide. Hydrochloric acid should not be allowed to come in contact with the periapical tissue, and a saturated solution of sodium bicarbonate should be on hand to meet any such emergency.

From time to time, in the course of mechanicochemical preparation, the root canal should be washed clean of débris. This is readily accomplished in teeth with wide canals, but not so readily if narrow canals are present. The method consists of flushing the canal with hydrogen peroxide U.S.P., by means of a syringe to which a blunt needle is at-

tached. In anterior teeth, the syringe needle may be placed half way up the canal at times. It should never be so placed as to bind in the canal, and only slight pressure should be used upon the piston. A cotton roll should be held at the incisal or occlusal surface of the tooth to absorb the solution as it drips out of the canal. Final washing of the canal should be done with double strength Labarraque's solution instead of hydrogen peroxide. This is a chlorinated solution which efficiently dissolves pulpal débris and will neutralize the tendency of hydrogen peroxide to produce gas. Flushing the canal will often wash down a surprising amount of débris and detritus and help in preparation of the canal for disinfection.

The prepared canal should not only be free of organic débris and detritus, but should also be of such form and width as to facilitate hermetic closure of the canal by means of a root filling.

It might be mentioned here that, in the past, too much stress had been placed upon the disinfectant used in the canal and not enough upon preparation of the canal. Remember: "It is not so much what you put into the root canal as what you take out that counts."

DISINFECTION OF THE ROOT CANAL

(a) Pulpless Teeth Without Areas of Rarefaction.—When the canal has been made patent through the apical foramen, when all the necrotic tissue on its surface has been removed and when the canal is wide enough to receive a root filling, efforts are then directed toward root-canal disinfection. Disinfection of the canal is only a link in the chain of root-canal treatment and is of no greater importance than any other phase of the root-canal operation. One should not place too much trust in powerful drugs for root-canal disinfection "which may kill germs by the thousands and phagocytes by the tens of thousands." Instead, that drug should be selected which is an effective germicide and which is also well tolerated by the tissues. In my own practice, either chloro-camphene or azochloramide is used.

Chloro-camphene is the trade name for p-monochlorphenol and camphor. Monochlorphenol is made commercially by passing chlorin over liquefied phenol. Camphor is added to overcome its caustic and irritant properties. It is a somewhat oily solution having a pungent, penetrating odor. It is stable and will not stain tooth structure. It has been used effectively as a root-canal disinfectant for many years.

Azochloramide is a synthetic organic chlorine compound, an effective antiseptic in the presence of pus, serum or organic matter. It was developed as a substitute for surgical solution of chlorinated soda (Dakin's), which gives up its chlorine rapidly and loses its antiseptic effect quickly. Azochloramide, on the other hand, gives up its chlorine slowly and has a more prolonged antiseptic effect. Clinical tests indicate that azochloramide has one drawback as a root-canal disinfectant: it will occasionally stain teeth light yellow or brown unless the pulp chamber has previously been well covered with a cavity varnish. Although the staining occurs rather seldom and the discoloration may be bleached out very simply by means of a reducing agent, the possibility of staining the tooth does limit the usefulness of azochloramide in anterior teeth.

If one of the older root-canal disinfectants is to be used, creosote stands out preeminently. Not cresol and formalin, against which one is to be cautioned, but old fashioned beechwood creosote. If one has no objection to its odor and precautions are taken for sealing it securely against leakage, I can see no contraindication to the use of beechwood creosote as a root-canal disinfectant.

Regardless of which drug is used in

the root canal for purposes of disinfection, the dressing should preferably be changed twice a week, and not less often than once a week. Drugs become absorbed in the root canal and lose their maximum effectiveness after a time. The disinfectant should be renewed often enough to maintain the balance between bacteria and disinfectant in favor of the latter. In acute cases, where there is considerable seepage, the dressing may need to be changed daily, or every other day, to prevent damming up of the secretion, with resultant edema and pain.

(b) Pulpless Teeth with Areas of Rarefaction.—Pulpless teeth with areas of rarefaction, and those pulpless teeth which fail to respond to topical medication, are preferably treated by electrosterilization. On the basis of laboratory study and clinical experience, electrosterilization, when used intelligently, may be regarded as the most effective method at our disposal for root-canal disinfection. Appleton and I[2] have shown by laboratory tests that the antibacterial effect of a root-canal disinfectant is more than twice as great when electrosterilization is used. Prinz and I[3] have shown by clinical tests that electrosterilization is more effective than topical medication. Were it not for the fact that the method is somewhat more time consuming per visit, it would be more generally used. In difficult cases, i.e., where ordinary methods of root-canal treatment have failed to yield a negative culture, and in cases with definite evidence of periapical involvement, electrosterilization is the method of choice.

BACTERIOLOGIC EXAMINATION OF THE ROOT CANAL

Bacteriologic examination of a pulpless tooth to determine the effectiveness of treatment is one of the most neglected phases of root-canal work. Since the object of root-canal therapy is elimination of micro-organisms from the canal surface and contiguous periapical tissue, we must have some means of knowing when this has been accomplished. Dependence on examination of the root-canal dressing by the visual and olfactory senses is not warranted. The only dependable method is the bacteriologic method. If I were to impress upon you nothing else but these two things: (1) that no pulpless tooth should be filled without first having yielded a negative culture and (2) that the technic for taking a culture is so simple that any intelligent dentist can carry out the procedure in two minutes; and if, in addition, I could persuade you to culture every root-canal case, I should feel that my efforts were well spent. Available data tend to show that when the sight and smell method is used for deciding when to fill the root canal, the guesses are wrong almost half the time.[4] Also, statistical data indicate that the chances for a successful result from root-canal treatment are a little better than 2 to 1 when a negative culture is obtained.[5]

If a negative culture has not been obtained after three or four attempts, in spite of a careful technic and adequate treatment, either extraction or root amputation should be considered.

FILLING THE ROOT CANAL

Root canals are commonly filled with gutta-percha, which is quite satisfactory in many hands. Some years ago, I felt rather disappointed in my own root-canal fillings and tried what was then a new method of filling canals. This consisted of filling the canal with a pure silver point in conjunction with a root-canal cement. The results were quite gratifying from the beginning, and having used the method now for about ten years, I believe it has many advantages over gutta-percha, for the following reasons:

1. The canal is easily filled in both vertical and lateral dimensions. The silver point may be prefitted so as to reach the apex, and the root-canal cement which is used in conjunction with

the point assures a hermetic filling laterally.

2. Narrow canals are more easily filled because the silver point will follow the course of the canal more readily, since it has the necessary stiffness, yet is flexible enough to adapt itself to the course of a curved or tortuous canal.

3. Better control is had in filling canals with wide open foramina because a prefitted silver wire of the same diameter as the canal can be used.

4. The silver point may be sterilized in the open flame just before use, to assure an aseptic technic to the very last step in root-canal treatment.

In practice, the silver point may be used as a diagnostic wire and if it fits the canal satisfactorily, the point can be put aside, ready to be used when the bacteriologic report is favorable. Cements of various composition may be used for filling the canal in conjunction with a silver point. The cement that I have found satisfactory has the following formula:

Powder	
Precipitated silver (C.P.)	3 iv
Powdered W.W. rosin	3 vi
Zinc oxide (reagent)	3 viii
Liquid	
Eugenol	3 vss
4% sol. zinc chloride (clear by filtering)	3 ss

Shake vigorously before use. If the cement sets too fast, add more eugenol to the liquid.

The technic of filling is as follows: The canal is first thoroughly dried with paper points. While the canal is being dried, the cement is mixed on a sterile glass slab with a sterile spatula, both of which are prepared by washing thoroughly with alcohol and chloroform just before use. When the cement is mixed to a thick creamy consistency, a small portion is carried into the root canal on a flexible root-canal plugger. The canal is well coated, a little of the cement being worked up at a time. An effort is made to carry a drop of the cement to the apex of the tooth. This being done, the cement is mixed thicker and the silver point is sterilized over an alcohol flame, then rolled in the cement until it is well coated. The point is now carried into the root canal by means of cotton pliers and is slowly worked up into the canal until it becomes seated. An x-ray picture is then taken without removal of the rubber dam. If the filling needs adjustment, it is made at this time, the point either being forced further toward the apex, as is generally the case, or removed, trimmed and reinserted in the canal. Another x-ray picture is taken to check on the filling.

While this method of filling root canals has been eminently satisfactory in my hands, there are times when an equally good canal filling can be made with gutta-percha. As a matter of fact, I still fill canals occasionally with gutta-percha. On the whole, however, I prefer the silver point method because it is simpler to carry out and because the possibility for filling the canal hermetically is greater by this method than by the gutta-percha method.

X-RAY CHECK-UP

After the canal has been filled satisfactorily, an x-ray record should be made, to be filed and compared with similar records made from time to time. It is my practice to have the patient return semi-annually for the first two years, then annually for at least a five-year period. If retrogressive changes are noted, the tooth should be removed. In the presence of suspected focal infection, teeth with retrogressive changes or those showing no improvement in the periapical condition should be removed. On the other hand, when the periapical condition of the tooth gives evidence of improvement over a reasonable period of time, extraction should not be carried out except as a last resort even in the presence of suspected focal infection.

CONCLUSION

Pulpless teeth will no longer be under

criticism when those who practice root-canal work acquire a critical attitude toward their own work in the selection of cases for treatment; in using bacteriologic control for determining whether the objective of root-canal treatment has been attained, namely, elimination of bacteria from the canal and contiguous periapical tissue, and in checking the condition roentgenographically for some time after root-canal treatment to determine whether the root-canal operation has been successful.

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SULFANILAMIDE AND UREA IN THE TREATMENT OF OSTEOMYELITIS

By CLYDE B. KAYNE, D.D.S., West New York, N. J.

OSTEOMYELITIS has long presented a problem to the profession. An outline of the etiologic and pathologic factors in, and the complications attendant on, this disease, together with a discussion of the modern concept of treatment, may serve to meet this problem, to some extent.

Osteomyelitis occurs as a result of infection of odontogenous or hematogenous source.

The odontogenous sources are (1) any dental surgical operation, (2) fracture of the jaw and (3) lesions of the soft tissues.

1. In surgical procedures in the oral cavity, as in extraction of a tooth, removal of an unerupted or impacted tooth, extirpation of a cyst or an alveolectomy, the bone may be exposed to infection, especially when trauma is great. Many times, osteomyelitis is the direct result of injudicious extraction. Before surgical intervention, it is always wise to wait until any acute inflammations or swellings, accompanying any of the above-mentioned surgical procedures, have subsided.

A case in point follows:

History.—A man, aged 45, whose chief complaint was a painful swelling on the left side of face, stated that, two weeks previously, he had had a lower left second molar extracted. A painful swelling developed in this area, with difficulty in opening the mouth. After the extraction, the swelling became progressively larger and harder, and, after a few days, a continuous discharge of pus from the open socket was noted. This had continued to the present time.

Examination.—A hard, indurated swelling on the left side of the face extended from the angle of the mandible anteriorly to the region of the corner of the mouth, and from the zygomatic arch area downward under the lower border of the mandible, encroaching on the midline of the neck. The entire area was dusky red, tense and painful to the gentlest palpation. A point of fluctuation was present at the lower border of the mandible in the first permanent molar

area. Unilateral submaxillary lymphadenopathy was present on the affected side.

There was a slight trismus. Pus was discharged from the lower left second molar socket on palpation in the mucobuccal fold. Sublingually, pain was elicited on palpation. The temperature was 101.6° F. Extra-oral and intra-oral x-ray examination revealed an osteomyelitic process.

2. Fractures of the jaws account for a great many cases of osteomyelitis. In a large majority of cases, fracture of the jaws are usually compound, especially in the mandible. In these instances, infection of the wound is followed by necrosis of the ends of the fragments. Teeth in the line of fracture should be removed, as they usually are devitalized and consequently act as a definite source of infection. In illustration, I cite the following case:

History.—A man, aged 22, whose chief complaint was pain and swelling in the right side of the mandible, stated that he had been injured in an automobile accident three weeks previously. There had been extreme pain, with swelling on the anterior aspect of the lower jaw and neck for a week, after which the pain subsided, but not the swelling.

Examination.—The swelling extended from the right to the left cuspid area, involving the lower lip, and downward under the lower border of the mandible to the hyoid bone. The entire area was painful on palpation, with fluctuation in the midline just under the lower border of the mandible.

The lower right first bicuspid exfoliated with indications of fracture in this region. Pus exudated from the gingival crevices of the lower right first bicuspid. The temperature was 99° F.

X-ray examination revealed (aside from small fragments of bone evidently chipped at the time of the accident) beginning sequestration at the lower border of the mandible, which was confirmed by x-ray pictures later.

3. Lesions of the soft tissues may result in osteomyelitis. A pericoronitis of the third molar may be the cause, especially when the organism is virulent. The acute infection here spreads into the retromolar area, causing a stripping of the periosteum from the bone and extending into channels of the bone proper. To illustrate:

History.—A man, aged 27, whose chief complaint was swelling and intense pain on the left side of the face, stated that a week previously he began to experience pain in the lower left third molar, which was partially erupted. The next day, a swelling occurred, which persisted, progressively increasing in size. The pain became more intense and the patient found it more and more difficult to open his mouth.

He had had, for the past two years, four intermittent attacks of pain and swelling in the same area, each of which subsided after two or three days.

Examination.—There was extensive indurated swelling extending from the posterior aspect of the angle of the mandible to the corner of the mouth, and, above, from the outer canthus of the eye downward under the lower border of the mandible of the midline of the neck. Submaxillary lymphadenopathy was present. The entire area was tense, dusky and very painful to gentle palpation.

Because of extreme trismus, it was very difficult to make an intra-oral examination. However, sufficient access could be obtained by slight retraction of the cheek. A pericoronal inflammation in the lower left third molar region was found. Only the mesial half of this tooth was erupted. The distal half was covered by a flap extension of the retromolar tissues. The patient experienced extreme difficulty in swallowing. The temperature was 101.2° F.

Extra-oral x-ray examination, at the time of the first visit, revealed suspicious bone changes. The presence of an osteomyelitic process was confirmed a week later by an x-ray check-up.

There have been reports of acute Vincent's infection resulting in an osteomyelitis in the same manner as in a pericoronitis. Cases have been reported of a carbuncle of the face producing an osteomyelitic process by direct extension into bone.

Osteomyelitis due to hematogenous infection is the result of an infected

thrombo-embolus borne by the blood from a lesion elsewhere in the body. Proof of this is furnished by the occurrence of osteomyelitis during the course of infectious diseases, especially typhoid fever and influenza.

In a hematogenous infection, the onset and course of the disease is usually acute and, for that reason, the oral surgeon seldom sees hematogenous cases with a clear-cut etiology. By the time the patient comes in for treatment, the lesion is so extensive that the teeth and jaw are involved, and it is almost impossible to evaluate cause and effect. In many instances, the dental pathologic condition dominates the picture at this time.

The extent of the pathologic involvement, which is evidenced by bone necrosis, depends on the size and importance of the vessel or vessels occluded. The blood supply of the maxilla is furnished by the infra-orbital, descending palatine, sphenopalatine, ethmoidal, frontal and nasal and the external maxillary blood vessels. Nearly all of these vessels are derived from the trunk of the internal maxillary artery. The anastomosis is very free, and none of the arteries functions as an end-artery.

The mandible is supplied by the inferior dental blood vessels and from the periosteal circulation, derived from contiguous muscular and other arterial trunks. The occlusion of any, or a combination, of these vessels results in degenerative changes followed by necrosis of the areas supplied by them. Necrosis of the lower jaw occurs oftener than that of the upper jaw because of the very much denser bone here, and also because of the fact that the maxilla has a greater blood supply.

The usual clinical picture includes the general and local symptoms associated with focal infection; namely (1) onset of pain and swelling in the infected tooth or jaw, (2) a rise in temperature, (3) chills, (4) toxicity and (5) malaise. The degree of these symptoms depends on the virulence of the infection.

The history given by the patient frequently includes a visit to the dentist during which an extraction was performed, followed almost immediately by any one or a combination of the foregoing symptoms. Some cases include a history of one or of several operations of incision and drainage in areas, either intra-orally or extra-orally. A characteristic manifestation is an aggravation of the objective symptoms each time additional incisions are made. It may be well to note here that x-ray examinations will disclose the presence of sequestration only in from ten days to two weeks after onset of the lesion.

Once an osteomyelitic process has been diagnosed, a rational procedure of treatment should be employed. At the onset, and for several days thereafter, the infection is at its greatest virulence, and swelling may be most marked. The patient usually has a temperature of between 101 and 103°F., and it may be higher.

TREATMENT

I use the following course of treatment: rest in bed (hospitalization preferred), increase in fluid intake and sedation, including relief of pain. Sulfanilamide is the drug of prime importance at this stage because the organism responsible for the acute symptom is often the streptococcus. For adults, the dose of this drug for the first twenty-four to forty-eight hours is about 90 grains (6 gm.) per day in divided doses. If the temperature recedes, the dosage is then reduced to about 60 grains (4 gm.) per day, in divided doses, until complete recession of the temperature and a general improvement take place. If the temperature does not recede, the initial dose of about 90 grains is maintained until such time as the temperature does drop or abscess formation takes place.

Care must be taken not to stop the

drug too soon, as relapses are prone to occur. Clinical observation has taught us that, in acute stages of osteomyelitis, the drug must be continued for at least two weeks. For children, the dosage is correspondingly less. Whenever it is deemed necessary, the intravenous infusions of saline and glucose and blood transfusion should be employed.

Local treatment extra-orally should consist of cold applications, ten minutes of every hour for the first forty-eight hours. When it is evident that there will be fluctuation, wet heat should be applied. Intra-orally, irrigation with a hot 12 per cent solution of sodium sulfate should be employed at all times, until localization and abscess formation have taken place.

Abscesses tend to develop in definite areas of the face and neck. In osteomyelitis, the character and localization of any suppuration are determined by the anatomic and histologic structure of the bones, and by the attachment of the muscle tendon and fascial planes.

The treatment here is immediate incision and drainage following the usual surgical practice. Whenever possible, intra-oral incision should be attempted. However, in most cases, extra-oral incisions are necessary to permit adequate drainage. To again emphasize its importance: At the time of opening of the abscess, no surgical procedure should be employed on the bone proper. Usually, any such attempt is followed by an exacerbation of the swelling or a spread of the infection.

As the osteomyelitic process enters the late stages, sequestration occurs. As an aid in the efficient separation and dissolution of the necrotic portions of bone, a 50 per cent aqueous solution of urea is my drug of choice.

The use of urea is primarily intended for the protracted or late stage of acute osteomyelitis and for chronic cases of long standing. Its chief value is in its solvent action on protein compounds. To summarize the beneficial effects of urea: 1. In an aqueous solution, by its power to dissolve necrotic débris, both microscopic and macroscopic, it removes the chief deterrent to healing. 2. During the healing of the wound, it has no effect whatever on the fibroblasts. As a matter of fact, the granulation tissue appears healthier and more highly vascular after its use. 3. It is almost totally non-irritating to living tissue, and has no apparent action on the normal bone with which it comes in contact. 4. It is mildly bactericidal, especially in those instances in which putrefaction is produced. 5. It eliminates odor. 6. Perhaps the greatest single benefit resulting from its use is that it does away with the necessity of added incisions for removal of large sequestra. In this way, patients are spared further deformity. This drug has been used in the cases illustrated here, as well as others, with excellent results.

In conclusion, I wish to emphasize two points:

1. Conservative treatment in any surgical procedure, together with a minimum amount of trauma, will serve to lessen the incidence of osteomyelitis.

2. Once an osteomyelitic process is evident, a rational therapeutic treatment should be instituted. The use of sulfanilamide and urea is of great value.

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ANALYSIS AND CONTROL OF POSTOPERATIVE COMPLICATIONS IN THE MANDIBULAR THIRD MOLAR AREA

By J. P. Henahan, D.D.S., Hollywood, Calif.

THAT phase of postextraction therapy related to the mandibular third molar alveolus and the third molar area has been selected as the subject of this discussion.

This particular area is visited with disturbances after exodontia in a greater percentage of cases than is any other area of the mandibular alveolar ridge, partly because it may become involved by any of the influences which beset postextraction wounds elsewhere and partly because of conditions peculiar to it alone.

The third molar area of the mandible is characterized by an arrangement of anatomic structures which exerts pronounced mechanical effects upon the open third molar alveolus or extraction wound. No other area of the mandibular ridge is affected similarly.

This alveolus is located in a vortex of activity created by the functioning of muscles and other structures in the area. It lies close to the dividing line between the oral cavity and the pharynx. The tissues overlying it take part in the functions of mastication, speech, swallowing, sucking and blowing.

This area is also particularly influenced by the constant changes from positive to negative atmospheric pressure which arise inside the mouth and which are due to the many functions.

Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 11, 1940.

The alveolus lies in the bone at the angle formed by the base of the coronoid process and the extreme distal extension of the alveolar ridge.

The third molar tooth, when crowded, cannot find a normal position in the alveolar process and is forced wholly or partly into the ramus, an abnormality of position resulting, and an irritant to overlying soft tissues.

True gingival tissue does not extend distally beyond the limit of the alveolar process and consequently the tissue which covers the tooth in malposition is something other than gingival, consisting of muscle fibers and other types of connective tissue.

The fact that this type of tissue does not divide before the force of an erupting tooth as does the gingiva will explain the frequency and persistence of the operculum which covers the occlusal surface of an incompletely erupted third molar. (Fig. 1.)

Here is an area of unusual vulnerability to open tissues at all times, even though the tissues are free from infection. There is present always a powerful secondary influence which, by agitation, thwarts Nature's initial efforts toward healing and leaves an open unprotected wound.

In the process of healing a dental alveolus or other alveolar bone wounds, Nature has recourse to either of two methods. The initial attempt is associated with formation of a blood clot, which seals the wound and protects it from invasion. If the clot survives, it

becomes a matrix in which take place the subsequent steps which lead to eventual calcification. This is Nature's first aid and quick repair method. For its success, conditions must be favorable. It may fail through dislodgment of the blood clot by mechanical disturbances or through disintegration due to bacterial action.

The second method is the slow granulation process, which begins with formation of a thin epithelial film to cover the inner surfaces of the bone wound, followed by gradual thickening from the deepest parts until the wound depression is finally filled in and calcified.

Between the failure of the blood clot and establishment of the epithelial film, there is an interim in which the bone

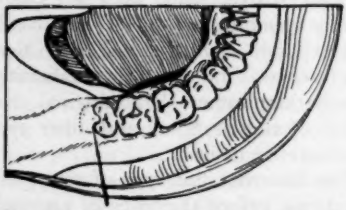

Fig. 1.—Distal extension of gingival tissue; muscle fibers in operculum.

is left without any protection from Nature, exposed to bacterial and chemical irritation.

This interim is a time for anticipation and for substitution of preventive and protective measures to function for the missing blood clot. Prophylaxis is the most valuable measure at this time. It is indicated for every type of wound large or small and under all conditions of physical health and resistance.

The efficacy of prophylaxis is to be gaged by the thoroughness with which it is carried out. Neglect of prophylaxis is one of the principal causes of postextraction complications.

The behavior of third molar area bone wounds will be influenced by the health and texture of the proximal bone, which will determine the progress of repair.

Bone of normal texture is found in the majority of these wounds. In others, bone of excessive density may be seen. The normal condition indicates an absence of excessive mechanical strain or chronic infection.

This is the most favorable type of open alveolar bone wound and, under normal conditions, repair processes can be expected to proceed without complications. Normal bone is not too hard to permit prompt passage of new arterioles through it to the lamina dura, or other internal wound surfaces. When this has occurred, we have the first and most important step toward granulation and

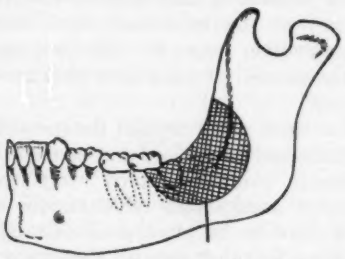

Fig. 2.—Area of non-pathologic bone condensation.

permanent natural wound surface protection.

Excessive bone density is the result of either of two different conditions and the surgical character of the bone varies accordingly. One type of condensation of bone is traceable to the tremendous mechanical stress placed upon all parts of the angle of the jaw and the continuous effort of Nature to add strength to that part of the bone, eventually resulting in an abnormal degree of calcification, the evidence of which is more pronounced in maturity than in youth. This condition is sometimes encountered in its extreme form during impacted third molar operations. (Fig. 2.) At times, the cortical bone of the external

oblique line and the buccal plate of the ramus is found thick, white and earthy, and of such density as to turn the edges of chisels and drills in efforts to excise it. The absence of blood is so evident in this condition that it is a mystery how the bone retains vitality.

This is not a pathologic condition, yet, for obvious reasons, it becomes a cause of long delay in the closure of wounds. Another type of excessive bone density is associated with bacterial irritation in chronic infection. This condition is an infected form of osteosclerosis. It may be seen in any area of the alveolar ridge where so-called low grade or controlled infection has persisted for a long time. A common site is the apical area of pyorrheic teeth.

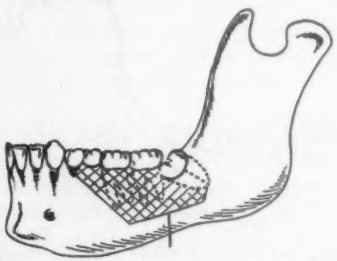

Fig. 3.—Area of sclerosis associated with chronic infection.

In the third molar area, this condition may be the result of subgingival infection about the crown of a long impacted third molar or from pyorrhea, or, as is more often the case, it may be due to the presence of pulpless first or second molars. (Fig. 3.)

This condition may extend itself over a considerable area and to an uncertain depth in the bone. The excess of lime has been deposited here by Nature in its attempt to localize the infection. This is a pathologic condition in which the bone, in addition to undergoing hypercalcification, is also saturated with the products of chronic infection.

All forms of condensed bone must be decalcified through the blood stream and the bone returned to normal consistency before repair processes can proceed. In sclerotic bone, we have the most unfavorable condition for repair. Closure of the orifice before decalcification and granulation of the interior only increases complications.

Reaction may develop at any time after infected, sclerotic bone has been exposed owing to renewed activity of residual bacteria heretofore latent.

The condition in which the surgeon leaves a bone wound at completion of the operation may be important later. General form and outline influence the progress of repair, and the more irregular the bone wound, the more prolonged will

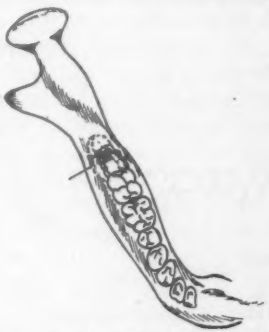

Fig. 4.—Trough between buccal and lingual cortical walls, impeding healing; buccal reduction for correction.

be the healing process. Attention to this important detail while anesthesia still prevails may avoid annoying developments. The object will be removal of hindrances to granulation and irritants to the internal surface of the covering tissues.

In large wounds extending into the ramus, troughs formed between the buccal and lingual cortical plates should be eliminated by reduction of the buccal wall downward toward the floor of the wound. The buccal bone margin should form a curve as long as possible. Thin ledges overhanging the depression at the base of the coronoid process should be

reduced, as well as the bone septum which had existed between separated roots. (Fig. 4.)

In addition, the floor of the wound should be made uniform by eliminating unevenness and sharp depressions. The rule is to avoid the bottleneck type and produce the nearest possible approach to a saucer-shaped wound. This eliminates the culdesac, which may be formed by the ledge and which provides the most favorable surfaces for granulation. Wounds so formed permit easier approach and more efficient wound prophylaxis and, lastly, the muscles will guide the recalcifying bone to assume normal form. (Figs. 5 and 6.)

At completion of an extensive exodontia operation, the wound must be left in a state of surgical cleanliness. Under this condition only can normal healing proceed without hindrance.

Fig. 5.—Bottleneck wound, which retains detritus and impedes granulation.

Physiologic rest is an important measure in all cases. The area of the wound should be without activity for at least twelve hours, to afford rest to the involved tissues and also to permit the blood clot to become organized.

When the blood clot survives for forty-eight hours, it is probable that the natural resources are in control and further procedures in the wound will be unnecessary. No symptoms should be evident other than tenderness in the area. When the blood clot disintegrates, protective measures by the surgeon become imperative.

Postoperative care implies repeated wound prophylaxis and other measures, from completion of the operation until granulation has built up a permanent protective covering for the exposed bone surfaces.

Every case operated upon is to be examined twenty-four to forty-eight hours later, according to requirements. The treatment plan may include both systemic and local medication, and it is well to anticipate nervous and traumatic reactions following trying surgical procedures.

The effect of sedatives and analgesics upon the central nervous system conserves the physical and nervous resources and therefore they may be employed judiciously for a brief period after operation.

Fig. 6.—Saucer-shaped wound, which is surgically ideal, facilitating granulation.

The barbiturates, which are widely employed as sedatives in dental practice, are efficient and relatively harmless. As analgesics, the antipyretic group of drugs fill all requirements. A combination of acetyl salicylic acid and phenacetin has been found particularly effective.

It is advisable, however, that the use of all these drugs be limited by evident requirements and not extended beyond forty-eight hours. Systemic medication alone is not to be relied upon. The local condition must be borne in mind, and failure to administer prophylaxis is neglecting the most important half of the treatment plan.

When the first postoperative examination reveals a clotless wound, immediate and thorough prophylaxis is indicated as a preventive measure. Every vestige of débris and blood clot detritus is to be eliminated, as it quickly undergoes putrefaction, with resultant foul odors, gas and irritation.

A bacteriophage is to be employed in thoroughly cleansing every recess of the wound. Phenol camphor is as effective as any medicament for this purpose. It also has obtundent properties; which lessens the discomfort of manipulation.

The patient is not to be permitted to neglect the care of the mouth. In such a case, the dentist can apply methods which will be effective in persuading the patient to do his part.

Preparations with deodorant and cleansing properties are to be prescribed and, with frequent and thorough use, they are an important auxiliary treatment.

It is of great importance also that, after from twelve to twenty-four hours, the patient resume exercise of the jaw. There is great prophylactic value in the intra-oral agitation produced by this activity.

When the jaws remain inactive owing to trismus or for any other reason, the mouth becomes an incubator for bacteria. The menace to the wound under this condition becomes greatly magnified. Gas may form and its tension may propel organisms through the exposed bone surfaces, or into areolar tissue which may already be engorged with lymph. In this period of mandibular inactivity, pus may form in the wound and find easy access to the submandibular spaces and to the neck.

This condition must not be permitted to exist for more than forty-eight hours, but must be corrected by opening the jaws, even if an anesthetic is required.

When a wound becomes septic, tissue resistance has been lowered and reenforcements are necessary in the fight against infection. Prophylaxis becomes more essential than ever, but the wound must be dressed also with an enduring preparation which will inhibit bacterial growth but not interfere with granulation.

Alveolitis is an early result of bacterial irritation, the symptom being severe pain. It is an unmistakable sign of the necessity for local measures for control. Iodoform gauze is a time-tested preparation which meets the requirements owing to its prolonged prophylactic property.

Pain control depends on the action of an obtundent drug, which must be combined with agents that will inhibit bacterial growth and eliminate foul odors. For this purpose, application of a combination containing essential oils, a few drops of guiaicol and 50 grains of ethyl aminobenzoate or chlorbutanol to the ounce will be found efficient. It is applied on a gauze tape barely dampened with the preparation.

Balsam of Peru applied to the gauze just before introduction into the wound acts as an emollient to new granulation tissue. This dressing also is excellent for the control of hemorrhage. Preparations applied on gauze are termed recoverable dressings as compared with pastes or waxes used by many operators for the same purpose.

Gauze dressings are not to be packed tightly into the wound except for the control of hemorrhage. Tightly packed dressings expand the wound and prevent granulation.

Ultraviolet light, when introduced directly into a septic wound by a properly shaped applicator, is of much greater efficacy than is generally understood.

Dyes also are of definite value, being indicated when granulation is progressing slowly and unevenly on the bone surfaces. Their use permits extension of time between dressings. Gentian violet possesses merit. It can be applied readily by inserting a small crystal in the

wound. It dissolves slowly and will spread over the interior, lasting seventy-two hours or more.

Heat, due either to inflammation or superficial application, promotes lymphatic secretion and accumulation in areolar spaces. Cold has the opposite effect, but is without any effect in elimination of accumulated fluid.

Sulfanilamide is employed as a cure more than for prevention. It is particularly effective in dealing with certain bacterial strains, but is not effective with others. It is to be administered in accordance with established methods of sulfanilamide therapy.

Asepsis of intra-oral wounds is difficult to maintain, but this fact, instead of being accepted to justify easy defeat, should, on the contrary, be accepted as a challenge by the operator who practices exodontia. Judicious use of non-escharotic antiseptics in the open wound during the operation, frequently repeated afterward during the stage of vulnerability, will bring gratifying results.

As yet, we have no new and astonishing remedies or methods available for intra-oral wound treatment. The secret of success lies in sensible and efficient implementation of means and knowledge which are at hand and which have been successfully tested by others.

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USE OF SILVER NITRATE IN THE TREATMENT OF CARIES

By H. A. ZANDER,* M.S., D.D.S., Chicago, Ill.

IN the pursuit of a practical science, one of the most important principles is a thorough understanding of the properties and reactions of the materials that are used. If dentistry, and in particular children's dentistry, is to continue to develop from an art to an exact science, it behooves us to more carefully examine our methods and the materials we use. Too many times in the past, forceful personalities and wishful thinking have been the substitutes for carefully controlled experimentation. Nowhere in dentistry can this be better seen than in careful examination of the available literature on silver nitrate and its application in the treatment of dental caries.

Silver nitrate became a sheet anchor in the treatment of caries very early in the life of the profession. Reference was first made to it in 1846, and since then it has become an integral part of our armamentarium. The purpose of this article is to compare with the literature carefully controlled laboratory findings and to draw conclusions as to the efficacy of this drug.

The first attempt to examine silver nitrate by scientific methods was made in 1902 by Szabo,[1] who tried to answer the question as to how far silver nitrate actually penetrates the dentinal tubules. He applied the rubber dam on first permanent molars with occlusal cavities, dried the teeth and applied silver nitrate in powder form and in solutions ranging from 10 to 40 per cent. He found that

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the penetration of silver nitrate through the whole carious mass into the sound dentin was not farther than 0.5 mm. Several applications of the solution did not change the depth of penetration. Szabo believed that silver nitrate combines with the albumin of the dental fibrils to form a silver proteinate, which stops further penetration of the silver nitrate solution.

In 1905, Miller[2] attacked the problem of the protection of dentin against acids by the use of silver nitrate. Precipitates of silver in the superficial layers of the dentin may form a barrier more or less impermeable to acids. He states that it may be the coagulation of the contents of the dentinal tubules which protects the dentin against the action of acids.

Fig. 1.—Photomicrograph of specimen; Class V (gingival third) cavity in upper right cuspid; specimen decalcified, sectioned and stained.

When Percy R. Howe[3] brought his ammoniacal solution of silver nitrate before the profession, in 1917, a renaissance in the clinical use of silver nitrate began. Howe's solution consists of silver nitrate crystals dissolved in distilled water, to which is added ammonia water, which throws down a black precipitate of silver oxide. This precipitate disappears when excess ammonia is added. Howe recommended this solution for the sterilization of the disintegrated dentin overlying pulps, as in large cavities of carious first molars. He reduced the silver from the ammoniated solution with formalin. Howe stated that his solution penetrated all affected dentin, but did not penetrate the sound tissue of the teeth.

In conducting his examination for sterility, Howe made bacteriologic tests anaerobically and aerobically, using agar, glucose-agar, blood serum and bouillon as media. Small pieces of dentin were smeared over the solid media or dropped into the fluid media. He found that cavities as ordinarily prepared for filling are not sterile. The organisms that he cultured from the deep dentin belonged to the Moro-Tissier group. He showed that these organisms remain alive at least six

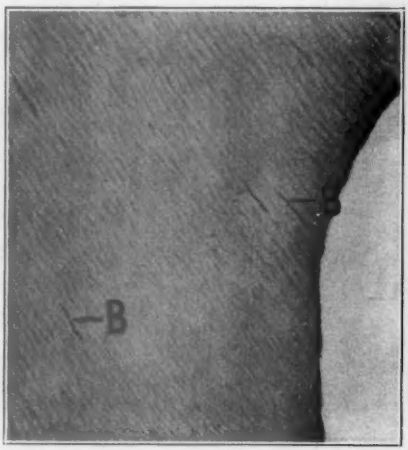

Fig. 2.—Higher mangification of A, Figure 1; micro-organisms (B) in dentinal tubules near mesiopulpal angle. The tubules containing micro-organisms are widely spaced and present a typical picture of the manner in which bacteria penetrate the dentin.

months under fillings, and grow vigorously when cultivated upon laboratory media. He thus tried to prove his point that, since these organisms are capable of living under fillings, all cavities should be sterilized before restoration. In these studies made by Howe at the Forsyth Dental Infirmary for Children, it proved wiser to treat rampant decay in the first permanent molars with silver nitrate than to run the risk of exposing the pulp through removal of all softened dentin.

Frequently, the question has arisen as to whether silver nitrate will penetrate sound dentin. L. R. Cahn[4] reports a case showing the penetration of silver

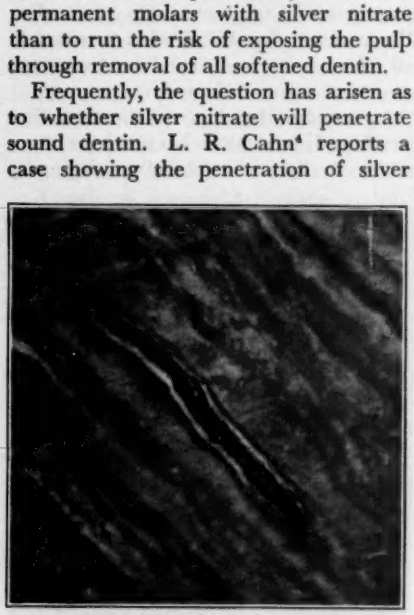

Fig. 3.—Higher mangification of a tubule containing micro-organisms.

nitrate from the pulp canal to the peridental membrane. He made celloidin sections of one root and ground sections of another root of a tooth treated with silver nitrate. He demonstrated in both types of sections the penetration of silver nitrate from the pulp through the dentinal tubules to the peridental membrane.

W. V. Booth[5] claims that the silver nitrate solution will not penetrate the healthy dentin and advises a practical application of this phenomenon. Undetected decay in cavities or any parts of the tooth affected by caries and not easily seen or felt will be quickly disclosed by the application of the ammoniacal silver nitrate solution and formalin.

Richards[6] states that the silver nitrate solution will penetrate to the full depth of decalcified tissues, but no farther. "On reaching unaffected tooth structure, coagulation takes place and the penetrating action automatically ceases."

Prime[7] has done more than any one else to popularize the use of the ammoniacal silver nitrate solution among the dental profession. Prime's own writings should be quoted:

> For years, in our efforts to remove every trace of decay we have destroyed innumerable pulps. How could we assume that every trace was removed? How do we detect such tissue? We have stopped when we removed discolored or softened tissue. If it was hard we concluded that it was sound tooth structure. It is necessary to use Howe's solution on only a few cases to learn how poor our methods are. Indeed, in some cases, a wall may have caries as much as a millimeter thick on it and we could not with our old methods know that it was there. After I had used it for only a short time I began to see why my patients had recurrent caries, uncomfortable teeth, and later, dying pulps.

Prime then used Howe's solution to disclose caries which might have been left in the cavity by the operator. As to the way silver nitrate discloses and sterilizes the carious spot, he states:

> The acid formed by the aciduric organisms dissolves out the mineral content of the dentin and for a time the matrix remains intact. On removal of the free water, by thorough drying, surface tension (capillarity) draws the solution into the spaces previously occupied by the mineral salts. When eugenol is introduced, the solution loses its balance and silver oxide, and possibly colloidal silver, with silver proteinate are deposited. We have literally made millions of little metal fillings in these spaces with our very finely divided silver particles.

Prime believes that the leather-like

substance of decayed dentin, which is "saturated with acid and bacteria," is changed into a "hard, sterile alkaline to neutral, inert substance."

What conclusions can we draw then from this short review of the literature?

1. Silver nitrate does not penetrate sound dentin. (L. R. Cahn disagrees.)
2. The solution penetrates to the depth of the carious dentin, sterilizing it.
3. The solution acts as disclosing agent for dental caries.

Upon the basis of these theories, the rank and file of dental practitioners have been using silver nitrate as a disclosing agent and as a bactericide in cavity preparation. It has been precipitated in fissures and grooves of both permanent and deciduous teeth in order to prevent decay, and it is used extensively to arrest decay in wide open cavities of deciduous teeth that it seems impractical to fill.

While clinical experiences seem to point to the effectiveness of these uses of silver nitrate, they have yet to be justified by controlled laboratory experiments. Valuable as the empiricism of the clinician is, his conclusions are often erroneous because of uncontrolled variables.

In order to prove the efficacy of silver nitrate as a sterilizing agent, we must show the depth of its penetration into decayed dentin as compared to the depth of penetration of the bacteria associated with dental caries. The bactericidal effect of the end-products of the silver nitrate on these bacteria is conceded. The question seems to be whether these end-products actually reach all of the bacteria.

In order to examine the data which will be presented later in this paper, a discussion of the accepted theory of dental caries is in order.

Caries is caused by chemical reactions of acids generated from carbohydrate materials. This process is furthered by enzymes from micro-organisms, and is followed by the proteolysis of the organic matrix of the tooth substance through the agency of other micro-organisms. Micro-organisms are thus necessary to the occurrence and progress of caries.

According to Black[8] and Miller,[9] softening of the dentin precedes the progress of the organisms through the dentinal tubules. Therefore, according

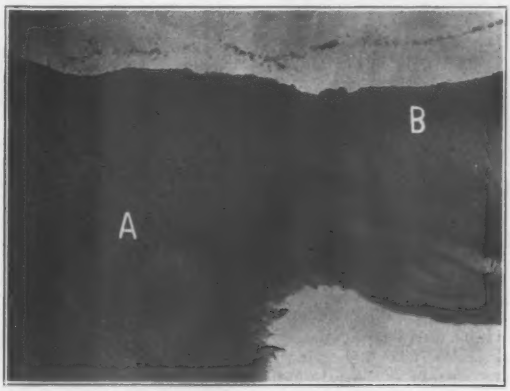

Fig. 4.—Photomicrograph of specimen 15; demonstrating penetration of silver nitrate into dentinal tubules. At A, the silver nitrate has penetrated 0.97 mm., the entire thickness of the dentin floor. At B, the penetration is only 0.09 mm. There are no bacteria beneath the cavity floor.

to their views, removal of the softened dentin was adequate precaution in cavity preparation, and, as Black stated, the use of drugs for cavity sterilization was not necessary. Hence the followers of Black used silver nitrate only when the softened dentin was not removed.

Recent work by Kronfeld[10] indicates that Miller's ideas were not correct and that the micro-organisms precede decalcification of the dentin.

In order to further investigate this problem, I performed the following experiment:

Carious teeth in which the pulp was not involved and which were to be extracted for reasons other than decay were selected. Ten cavities were prepared in these teeth in the mouth, a rubber dam being used. Black's cavity preparation was used. The decay was removed with spoons until nothing but absolutely hard dentin, which was impenetrable to a sharp explorer, was left.

Immediately on completion of the cavity, the teeth were extracted, instantly placed in fixing solution and subsequently decalcified and embedded in celloidin. Sections were made from these specimens 6 or 8 microns thick and were stained with a hematoxylin-Gram stain.

The results of this experiment are shown in Table 1. Figures 1, 2 and 3 show one of these cavities in which bacteria were found.

This would indicate that there is a microscopic difference in the course of caries. In the acute stage, as is so often seen in children's mouths, we probably have a wide area of softened dentin development of which precedes the actual invasion of the tubules by bacteria. In contrast, we have the chronic type of caries, usually found in older persons, in which invasion of the tubules is far in advance of the softening.

TABLE 1.—BACTERIA IN THE DENTIN AFTER CAVITY PREPARATION

Specimen	Tooth	Class of Cavity	Depth of Bacterial Penetration*	Distance of Bacteria from Pulp†
1	Molar	II	None	None
2	Cuspid	V	0.08 mm.	1.92 mm.
3	Molar	II	None	None
4	Bicuspid	II	None	None
5	Bicuspid	II	None	None
6	Cuspid	III	None	None
7	Cuspid	V	1.23 mm.	0.24 mm.
8	Bicuspid	V	0.27 mm.	0.79 mm.
9	Cuspid	III	0.27 mm.	1.59 mm.
10	Molar	I	None	None

*"None" means that bacteria were not found in the dentin walls of the cavity. The numbers in this column give the greatest depth at which bacteria could be shown.

†The numbers in the last column denote the distance in millimeters between the pulp and the furthest advanced bacteria. No bacteria were found in specimens 1, 3, 4, 5, 6 and 10.

TABLE 2.—CAVITY STERILIZATION WITH SILVER NITRATE

Specimen	Tooth	Class of Cavity	Depth of Penetration of Silver Nitrate*	Depth of Penetration of Bacteria Beneath Cavity Wall†
11	Cuspid	III	1.09 mm.	None
12	Bicuspid	V	0.53 mm.	0.67 mm.
13	Incisor	III	0.27 mm.	1.15 mm.
14	Bicuspid	V	0.18 mm.	None
15	Molar	I	0.97 mm.	None
16	Molar	I	0.95 mm.	None
17	Cuspid	V	0.43 mm.	None
18	Incisor	V	0.27 mm.	0.70 mm.

*The numbers indicate the greatest distance to which silver nitrate penetrated the floor or wall of the cavity.

†"None" means that bacteria could not be found in the walls or floor of the cavity. The numbers indicate the depth to which bacteria had penetrated the dentin walls of the cavity. The measurements were made from several sections throughout the specimen and the numbers represent the greatest depth observed.

In order to show the relationship between bacterial penetration and the penetration of the tubules by silver nitrate, the same experiment was performed, except that silver nitrate was precipitated before extraction of the tooth. Howe's ammoniated silver nitrate solution was used, precipitated by eugenol. The results are shown in Table 2.

As this table shows, the penetration of the silver nitrate varies considerably with the individual teeth. In one specimen, the penetration into the dentin was only 0.18 mm. In another specimen, it was

Fig. 5.—Photomicrograph of specimen 12. Bacteria at A penetrated as much as 0.67 mm. into the dentin beneath the cavity floor. Silver nitrate at B does not penetrate in any place to the same depth as bacteria. There are three zones of silver nitrate penetration. At C, there is an initial heavy deposit. D indicates a wide zone of penetration, and E a rather heavy line of deposit at the limit of the penetration.

1.09 mm. Also, in the same specimen, the penetration varies considerably, as seen in Figure 4. Here, the solution had penetrated in one place 0.97 mm., or almost to the pulp; while, in other places, it traveled lesser distances only. In Figure 5, bacteria are seen penetrating almost twice as far as the silver nitrate; which shows that the dentin previously invaded by bacteria has no special affinity for Howe's solution. This observation that the penetrating power of silver nitrate is independent of the invasion of the bacteria into the dentin was further substantiated by the fact that, in all three cavities, in which bacteria were left beneath the cavity walls, the bacteria pene-

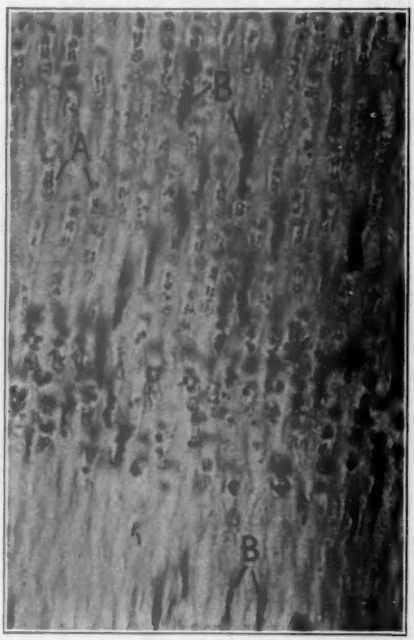

Fig. 6.—Higher magnification of F, Figure 5. A, silver nitrate precipitate. B, bacteria.

trated farther than Howe's solution. (Table 2.)

After this table was prepared, it was noted in several other cases that the silver nitrate penetrated deeper than the bacteria.

VALUE AS STERILIZING AGENT

It may be seen, therefore, that silver nitrate is not so effective as it is usually considered because it does not necessarily

penetrate the tubules as far as the bacteria do. It will certainly hold the bacteria in check as far as it penetrates. Silver in a finely divided state, which may be colloidal or be present as silver oxide, has bactericidal properties. Some metallic silver is deposited in the dentinal tubules when the solution is reduced with eugenol. As has been stated before, Nature is apt to defend herself against bacteria, and if silver nitrate helps her to reduce the number of bacteria that she has to fight, we aid her by sterilizing cavities with this solution. However, we should be conscious of the fact that silver nitrate is no magic substance and cannot be expected to reach unfailingly all the bacteria left beneath the cavity walls.

A phenomenon observed in all the silver nitrate specimens was the division of the region of penetration into three zones, as shown in Figure 5. The outermost zone is narrow and shows a heavy deposit. Then follows a wide zone of lighter deposit and, finally, an inner zone of heavy deposit. An explanation for this phenomenon cannot be given at the present time.

VALUE AS DISCLOSING AGENT IN DENTIN

If silver nitrate has any value as a disclosing agent for bacterial invasion of dentin, it should penetrate decayed dentin only. The following experiment was performed to see if there was any penetration of sound dentin:

Two non-carious teeth that were to be extracted for prosthetic purposes were selected for the experiment. The labial wall was ground away and the dentin exposed. Silver nitrate was applied and precipitated by the usual method. The results obtained are shown in Figure 7. In this case, silver nitrate has penetrated sound dentin 0.73 mm.

Fig. 7.—Penetration of silver nitrate into dentin of sound tooth. In some areas, the silver nitrate has penetrated the sound dentin as much as 0.73 mm.

While we are all familiar clinically with the startling way in which certain areas are deeply stained after the removal of the soft decay of a carious tooth, these findings cast some doubt as to whether these deeply stained areas are actually carious or may be due

to differences in structure of the tooth.

PRACTICAL APPLICATIONS

An attempt will be made to correlate these findings with practice, and an outline will be made to define the advantageous use of ammoniated silver nitrate and its limitations.

1. In preparing a cavity to replace tooth structure lost from chronic decay, the preparation should be made deeper than usual in order that the apparently hard dentin affected by micro-organisms may be eliminated, if this is possible without endangering the pulp.

2. Nitrate of silver should be used as a matter of routine in all cavities where the appearance is not important.

3. Use of silver nitrate does not excuse the leaving of decay or softened dentin in the bottom of a cavity, except when removal of such decay will expose the pulp. In the latter case, there should be a definite understanding by both dentist and patient that there is a strong likelihood of the bacterial process continuing until the pulp is lost. It may be noted that the large percentage of successes following the application of silver nitrate in first permanent molars where decay is rampant and large masses of the dentin are leathery are probably due to the fact that the decay is of the acute variety and that there is no bacterial penetration of the dentin beyond the softened area. This lack of penetration, rather than the application of silver nitrate, is probably the most important factor.

4. The widespread use of silver nitrate in lieu of well-planned restorations is to be discouraged. Not only will decay not be arrested in most cases, but also loss of space in the arch will result.

5. In cases of deep fissures, Hyatt's prophylactic treatment is strongly recommended rather than the application of precipitated silver nitrate in the fissure.

6. The value of silver nitrate as a disclosing agent in dentin is doubtful.

7. The use of silver nitrate as a disclosing agent for superficial decalcification of enamel is of great value, apparently arresting decay for some time.

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A SIMPLIFIED TECHNIC FOR COPPER PLATING IMPRESSIONS FOR INLAY WORK*

By B. D. Lynn, D.D.S., Detroit, Mich.

THERE are three general processes of inlay construction: (1) the direct, (2) the indirect and (3) the indirect-direct, a combination of the first two. Each of these methods has its advantages and general indications, depending on the situation.

By the direct method, the wax pattern for the inlay is obtained by heating the wax, forcing it into the prepared tooth cavity and carving *in situ*. This method has its advantages in that the occlusion and contacts are accommodated in the same operation, and thus possible spot grinding is eliminated before the finished inlay is set. The contraindications in this method are the time consumed at the chair and the difficulty of obtaining a correct wax pattern in a region difficult of access, especially when the process is complicated by an excess of saliva.

In the indirect method, the wax pattern is constructed on a die, which is made from an impression of the prepared tooth. The principal disadvantage of this method is the introduction of another step in the procedure, thus adding another variable to the process. It is the purpose of this paper, then, to reduce and correlate the variables so that the end-product, the finished inlay, will fit properly and not be "an island of gold surrounded by a sea of cement."

After the cavity has been prepared and the impression carefully taken, the die is constructed. The operator has his choice of materials in this procedure: amalgam, die stone or copper plate. Each of these is being used and, in the hands of the experienced operator, excellent results are obtained.

The amalgam die has found great favor owing to its hardness after it is finished. It makes possible a feather-edge carving and a resultant fine casting. Furthermore, the inlay can be polished off prior to seating in the mouth. The disadvantages of the amalgam die are the cost and expansion-contraction change in the die itself, which are due to the preparation of the mix, the variable factors of trituration, mulling, etc.

Die-stone has been used because of its low cost and ease of preparation. The resultant die is only fairly hard and it is difficult to obtain accurate dies because of volumetric changes after setting.

Copper-plated dies have succeeded the amalgam and stone dies because they more closely approximate a perfect reproduction of the prepared cavity of the tooth. They are extremely simple to make and the cost factor is negligible.

THEORY

The principle of electroplating may be briefly described as follows: When an electric current is passed through a solution of metallic salts,[1] decomposition occurs, usually with precipitation of the metal. The electric current enters the solution via the anode (positive electrode) and, passing through the solution, leaves via the cathode (negative electrode). If the electrolyte is a solution of

*For the construction of a simple yet efficient copper plater, see the February 1940 issue of The Journal, p. 321.

1. Solution for copper plating:

Copper sulfate (not anhydrous)	ʒ	vii
Sulfuric acid	ʒ	ii
Water	ʒ	xxii

copper sulfate and a current flows from a copper anode to a metallized cathode, the solution is decomposed and the copper from the anode is deposited upon the cathode. It is this principle which is utilized in the making of copper-plated dies.

METHOD

The impression of the prepared tooth cavity is taken in the usual manner, with

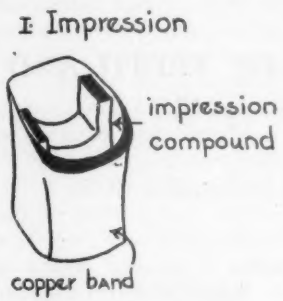

Figure 1.

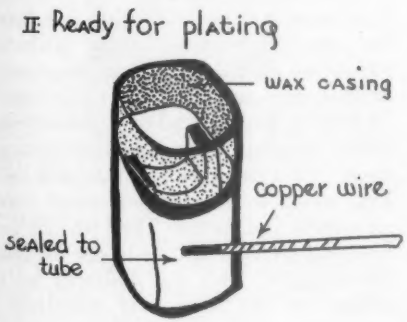

Figure 2.

impression compound and a copper band. The impression is carefully dried with several quick blasts of air from the chip blower. With a fine brush, a thin aqueous film of graphite[2] is coated over the entire surface of the compound that has been in direct contact with the tooth, as well as with the prepared cavity. The graphite is carefully dried with the chip blower. Any air bubble should be removed by the brush. Again the impression is dried and examined. The finished metallized surface presents a smooth blackish gray appearance. A little more of the graphite solution connecting the part already metallized with the band proper is painted on next.

A strip of wax (28-gage is best) is softened and cut so that it extends about three-eighths inch above the outer border of the band, while completely covering it. The prepared band is completely enveloped, making a complete seal all along the edge of the band. This seal must be absolutely hermetic. Failure will result in a ball of deposited copper at the flaw.

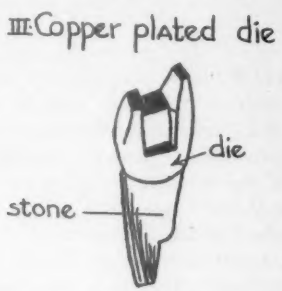

Figure 3.

A 3-inch length of copper wire of 18-gage (radio wire that has been treated with shellac or varnish is perfect) is selected and one-fourth inch of the coating is scraped off from each end. One end of the wire is flattened by beating with a hammer. With a sharp knife, a slit of the wax surrounding the impression band is cut away. The flattened end of the wire is placed in this slit and is waxed to place so that the wire is in direct contact with the impression band.

TECHNIC

After the impression has been care-

2. The metallizing graphite is moistened with 2 drops of tap water and applied with a fine brush.

fully prepared in the manner described, alcohol is dropped with a medicine dropper into the impression, to reduce surface tension. The alcohol is poured out and replaced with tap water. The impression is connected with the clamp and immersed in the copper sulfate solution. The current is turned on and left for about eight hours, or even overnight.

When metallization is complete, the impression is removed from the solution and rinsed several times with tap water. The metallized impression is poured with ordinary stone. After it has set (half an hour is sufficient), it is immersed in hot water to remove the impression band and the compound. The excess compound is washed off with xylene and the die is ready for use.

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ESTHETICS: SELECTION OF TEETH AND CORRELATED FACTORS

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ESTHETICS, as applied to complete denture prosthesis, may be defined as a combination of science and art. Art is in itself a science—the appreciation of the beautiful in form and color. By the skilful application of this science, we make beautiful restorations. A beautiful restoration is one which is so natural in appearance that it is not easily detected.

With the progress made in dentistry, and the dental education of the public through press and radio, the time is past when most edentulous patients will accept a prosthesis that is just a "plate." They know it is now possible to have pleasing and natural appearing artificial dentures and they will go where this type of service can be procured. Consequently, it is of the utmost importance that the dentists who are conscientiously trying to render this type of service make use of any and all factors in the ultimate production of the best possible esthetic results. Any detail which will assist must not be overlooked.

Scientific investigation and research have enabled the manufacturer to supply the dental profession with products which are constantly being improved. Several years ago, there was much interest shown, and a marked improvement made, in vulcanite available for denture bases. Then came the granular pink facings, which were an improvement from an esthetic standpoint. Then we had the base and facing vulcanite in one all-pink combination. This was followed by a deluge of the new base materials—celluloids, vinyl resins, phenol resins, etc., a great many of which have "gone with the wind." At the present time, the acrylic resins are much in favor as denture base material, and, considered esthetically, they are a great improvement.

Teeth for complete dentures have kept pace in advancement with denture base materials and show a similar improvement. Tooth forms have progressed

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from individually ground pieces of ivory to the high-grade beautifully formed porcelain teeth now available.

So it would seem that the manufacturers have done their part in supplying base materials and improved tooth forms and hues for esthetic restorations, and these new products should be an inspiration to us. However, to attain esthetic results in complete dentures, much more is involved than the raw materials. It is here that science and art must be supplied by the dentist; which requires time and effort and concentrated study. Dentists vary in their ability to build dentures of the highest esthetic type. However, by constant endeavor and by the conscientious application of esthetic principles, the quality of their restorations can be greatly improved. A careful study of natural teeth and their arrangement

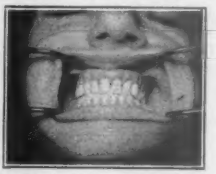

Fig. 1.—Complete maxillary denture, illustrating harmony of tooth-form, tooth arrangement and arch form with facial type.

is a means of helping the operator develop an artistic sense so that in edentulous cases he can readily visualize the type, form and arrangement that will best harmonize with the face.

PREEXTRACTION RECORDS

Photographs, facial masks and facial measurements should be taken, especially if it is advisable or desirable to reproduce the existing condition. This is particularly true in the case of very young patients who, for some reason, are about to become edentulous. The great majority of patients, however, do not consult the prosthodontist until the teeth have been removed, or until the natural dentition is broken up, with the teeth out of their natural or normal alinement and the facial proportions lost.

In these cases, preextraction records are of little value except to show the improved condition obtained with the new restoration. I believe that often too much stress is placed on preextraction records, and too much time and effort are expended in trying to reproduce the condition present when the patient comes to us. We accept this as the natural condition, when in reality it is not the height of Nature's perfection, and, for the best appearance, should not be reproduced.

In many of these cases, the first molars, or possibly all of the posterior teeth,

Fig. 2.—Three mold guide teeth (left) and three natural teeth (right), showing similarity of type, form and size.

have been missing for years, with resultant changes in facial proportions. The remaining anterior teeth have shifted from their normal positions and are worn and abraded to a greater or less degree. The overbite and overjet have been changed accordingly. Functional habits have been acquired which greatly interfere with Nature's original plan and have caused many changes which oftentimes we fail to recognize. I believe that the men in the prosthetic field who are doing work that is outstanding are not spending too much time on preextrac-

tion records; men with perhaps some native ability and who, through years of experience and study, are able to visualize and create rather than imitate. They create a restoration far superior to one that could be obtained by duplication to conform to preextraction records. It is my impression that it is the novice, the beginner, the inexperienced new graduate who, perhaps, in his desire to do something worth while, is busily engaged in taking facial measurements and gathering data of the old conditions to incorporate in the new restoration.

Fig. 3.—Facial mask: typical condition caused by insufficient vertical dimension.

Fig. 4.—Facial mask: Permanent record which shows improvement gained by establishing vertical dimension in harmony with other two-thirds of face.

We cannot always attain the ideal in a restoration, but must use judgment and approach it as nearly as possible. The age and health of the patient must be considered; also the length of time the edentulous condition has existed. It is inadvisable to attempt too much change in one who is aged or in poor health, and thus inflict too much strain on muscles and tissues. In these cases, it is wiser to make the change gradually and build subsequent dentures at intervals until we have attained the height of perfection which the patient will tolerate. A young patient should have the youthful appearance and contour restored; while for one who is older, the esthetic result is much more pleasing if the character lines and changes characteristic of older faces are incorporated in the new restoration.

SELECTION OF TEETH

So many factors enter into the building of a complete restoration that it is impossible to single out one step as more important than the rest. However, the selection of teeth is one step that some of us deem unimportant, or we have just become careless. This is obvious when we see so many otherwise good restorations utterly ruined esthetically by poor tooth selection. The dentures may have excellent retention and balanced occlusion and may be constructed of the finest materials, yet if the teeth are out of harmony with their surroundings in type, size, color and arrangement, the result is most displeasing. The teeth should be

selected by the operator, and in no instance should this step be delegated to a laboratory technician.

In selecting teeth for complete dentures, it is advisable to be guided by the generally accepted classification of the three typal face forms: square, tapering and ovoid. This classification is by far the most scientific and dependable of all that have been given to the profession. While we do not always find a tapering tooth with a tapering face, nor a tapering tooth supported by a tapering arch, this is conceded to be true in the majority of cases. Harmony in facial type, arch form and tooth form will produce a denture balance without conflicting lines. (Fig. 1.)

We hear so much about modification of facial types, and while these types do vary, with a slight modification, they are still classified as three distinct types. It is because of these variations that we have individuality. We have racial and family characteristics, yet no two people are identical. Even in identical twins, there is enough difference in features to distinguish one from the other. If, in taking preextraction records, some of the natural teeth are present, it is well to make use of them in determining the type and size. (Fig. 2.)

The baseplates, having been accurately adapted to the casts, are completed by the addition of wax contour rims. The vertical dimension is established and the desired facial contour is obtained by the design of the rims. On the labial surface of the bite-rims, the median line, the high lip line and the cuspid position are carefully recorded. Positional relations are then registered and the trial bases transferred to the articulator. To attain an esthetic result, contributing factors and their surroundings must be in proportion. The mold and size of the teeth selected must be in proportion to the length and width of the faces. The length of the maxillary teeth may be determined by measuring the vertical dis-

Fig. 5.—Typical edentulous condition.

Fig. 6.—Normal contour of lips restored.

tance between the high lip line and the incisal plane. The width of the six anterior teeth is determined by measuring with a flexible millimeter gage the curvature of the maxillary rim from cuspid to cuspid position. The teeth of the proper type which conform to these measurements are then selected from the mold guide, placed in position on the maxillary bite-rim, carried into the mouth and checked for type and size. Although extreme care is used in taking these measurements, the mold guide teeth, when in position on the bite-rims, are sometimes found to be unsatisfactory. If this is the case, a change to either larger or smaller teeth is necessitated. It has been my experience that teeth selected in the manner described are, as a rule, slightly smaller than would be indicated if they were chosen in proportion to facial measurements. I like to supplement this method with the Wayrin trutype guide, using the guide as a caliper only, to determine the length and width of the maxillary central incisors. Since the new restoration is to become actually an integral part of the patient, it is well to discuss the teeth selected with him at this time and gain his approval, to avoid changes later.

The length of the posterior teeth is determined by the distance from the cuspid to the end of the wax-bite rims, which have been previously terminated at the junction of the residual and non-stress-bearing tissues. Whether the teeth are of long, short or medium bite is determined by the vertical distance between opposing ridges. For esthetic reasons, it is best to use the medium or the long bite teeth whenever the vertical distance will permit.

The selection of the type of posterior teeth, which is an important factor in esthetics, is too large a subject to be

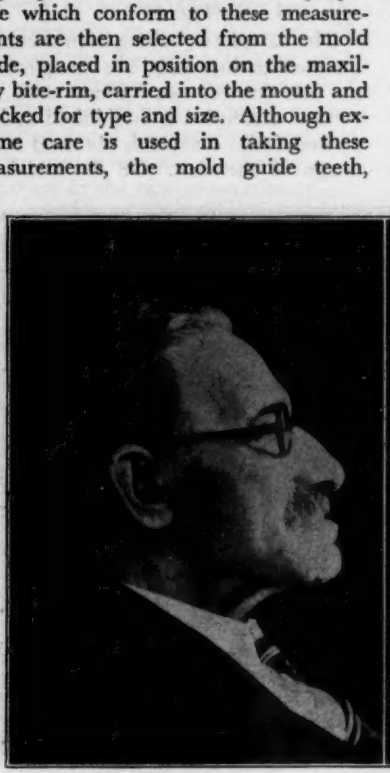

Fig. 7.—Tense and strained facial expression due to malocclusion dentures not in correct centric relation.

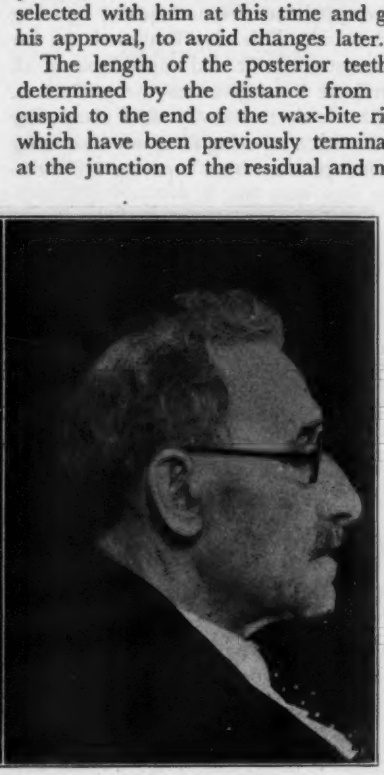

Fig. 8.—Relaxed, composed and pleasing expression, result of wearing comfortable dentures in normal centric relation.

covered in a short time. It constitutes a major factor in itself. Suffice it to say that we must recognize the fact that no one type of posterior teeth is suitable to all ridge conditions and ridge relations. Nothing contributes more to the patient's discomfort than the soreness and trauma caused by malocclusion dentures, which are evidenced by the distressed, irritated and painful facial expression. This is the direct opposite of the composed, pleasing and natural expression for which we strive. The correct type of posterior

Fig. 9.—Edentulous patient aged 15, showing aged appearance and mental depression.

teeth are of great assistance in avoiding this condition, and tooth selection should be given much more consideration.

COLOR SELECTION

Color is any one of the hues of the rainbow or spectrum or a tint produced by the blending of two or more of these hues. Harmony is accord in conformity, symmetry and unity. Color harmony, then, in teeth, is a hue that blends and conforms to the combined color of complexion, hair, eyes and lips, and forms a unity with them. Nature tends to maintain harmony in body pigments. In the skin, eyes, hair and natural teeth, there is usually a harmony of color. We have all seen people with hair dyed a shade very different from the natural and we are at once conscious of the conflict produced and the discord in color between the hair and skin. In a like manner, a lack of harmony between the color of the teeth and the complexion is equally unpleasant and conspicuous. It is desired that the teeth be a component

Fig. 10.—Photograph taken six weeks later (compare Figure 9) with patient wearing complete dentures; edentulous complex completely overcome and facial expression and mental attitude improved.

factor and, by their conformity to the rest of the face in hue, type and mold, become an inconspicuous contribution to the complete restoration. In natural teeth, we have a nerve and blood supply that gives luster and vitality to the tooth. The manufacturers of porcelain teeth strive to imitate this condition by pigmentation in the body of the tooth for

color and in the glazed surface to reflect light.

In selecting the hue, we must keep in mind the surface form of the tooth. Whether convex or flat, its form is bound to affect the amount of light reflected from its surface. The convex surface diffuses or scatters the light rays reflected, while the rays from the flat surface are reflected parallel to each other, thus causing the tooth to appear larger and of lighter hue than a tooth of the same size whose surface is convex.

Our first impression in color selection is usually more accurate than any subsequent impression based on long study and meditation. One should try several shades which, according to classifications, will best harmonize with the patient's coloring, then arrive at a choice by elimination. After we have decided upon the shade, the six maxillary anterior teeth are tried in the mouth and checked. We must bear in mind that the color of the teeth is affected by the shadows produced by the lips, the darkened oral cavity back of them and the base material by which they are supported. We must also remember that the color of the skin and the color of the hair and the eyes change with age, and, consequently, older patients require a tooth heavier in color to harmonize with these changing conditions. Because of these changes, a tooth tint suitable for a patient of 35 years will not be correct when he has reached 50 or 60 years.

After fifteen years of experience in teaching complete denture construction, I am of the opinion that, in selecting teeth, it is better to rely on one's judgment, artistic sense and ability to recognize harmony than to adhere too rigidly to any fixed set of rules. Every complete restoration is an individual problem, which cannot be carried out according to a predetermined course of procedure. When we follow too closely generally accepted standards, we lose individuality, and denture construction becomes just the mechanical routine of mass production. As A. Alfred Nelson expresses it: "No system of tooth selection yet devised will automatically bring perfection. Nothing can relieve the operator of the responsibility for cultivating the esthetic sense of fitness that will enable him to visualize a harmonious combination, or detect a discord in the relation of face and denture."

VERTICAL DIMENSION

If the anatomic development has been normal, and the forehead, nose and chin are equally developed, it is an easy matter to measure the face and establish the ideal vertical dimension. But when Nature varies in this normal development, we are confronted with a more difficult problem. While the facial dimensions may not be equal, the operator will be able to establish a vertical dimension that will be in harmony with the other two-thirds of the face, but may not be exactly proportionate to them. The lips should be free from strain, and it should not require any great effort on the part of the patient to bring the lips into contact. The dentoprofile scale is of material assistance in restoring the lost dimension. Correct facial dimension and proportion are of vital importance to assure a natural, symmetrical and pleasing appearance. (Figs. 3 and 4.)

CONTOUR OF THE LIPS

Unless the contour of the lips, which is the key to the highest esthetic effect, is properly established, the expression and character of the face will be lost. The operator has four fixed guides which will assist in determining the proper facial contour:

1. The contour of the head at the hair line.
2. The prominence and contour of the brow line.
3. The fulness and contour of the cheeks laterally through the malar regions.

4. The prominence of the chin. Having the contour of the four, it is merely a question of rebuilding or producing the contour of the fifth, the lips, which will be in harmony with the other four. (Figs. 5 and 6.)

CENTRIC RELATION

Correct relationship of the mandible to the maxilla is absolutely essential for comfort and proper functioning of the dentures. Muscles function properly only when the distance between the origin and insertion remains unchanged. Thus the muscle tone is developed by exercise, and this, in turn, improves the facial contour. The patient wearing maloccluded dentures which are not in centric relation always has a strained, unnatural facial expression. (Figs. 7 and 8.)

ARRANGEMENT OF TEETH

The arrangement of teeth is a subject of its own. I shall mention only a few of the factors in esthetics. The first consideration in arranging artificial teeth is a duplication of the natural dentition, provided, of course, this is desirable and study casts and preextraction records are available to serve as guides. The second consideration is to create a new and improved condition. This is oftentimes accomplished by a modification or slight variation and by introducing some irregularities which harmonize with the patient's characteristics. The third consideration is the arrangement of the teeth to balance and equalize unsymmetrical facial proportions. In these cases, corrective art is made use of in creating a new condition that will improve upon or conceal the natural condition by establishing a balanced relation between the right and left sides of the face—a bilateral balance.

When patients reach the time in life that might normally be considered the denture age, the natural teeth have become worn and abraded. This is especially apparent on the labio-incisal line angle of the mandibular incisors. By grinding the incisal edges of the mandibular incisors to simulate the worn condition of the natural teeth, a more natural appearance and a more pleasing esthetic result is obtained in the restoration. This grinding eliminates the youthful appearance of the teeth and harmonizes them with the other changes that age produces.

BASE MATERIALS

Base materials that improve the appearance by closely matching the natural gum are essential, especially in the case of prominent ridges and short lips. With the great improvement made in these materials recently, there are several from which to choose, all of which meet the esthetic requirements.

Modern dentures should be works of art. I have enumerated some of the factors in producing artificial restorations that closely imitate nature.

Much study and effort are required in producing a restoration which not only functions satisfactorily, but which will also comply with the esthetic requirements; and the greatest compensation one receives from this work is the satisfaction derived therefrom. (Figs. 9 and 10.)

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CORROSION OF DENTAL ALLOYS

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INTRODUCTION

Recently, renewed interest has been evinced in the idea that metal restorations may be the cause of some types of mouth irritation. Certain investigators[1-26] are of the opinion that irritation may be caused by an electric current from a galvanic couple formed from dissimilar metals, which serve as electrodes. Other investigators[27-30] believe that a galvanic cell, if present, will be rendered harmless by polarization, protective coatings or a lack of an external circuit between the metals. Still others[31, 32] are of the opinion that the conditions necessary for galvanic action are not present in the mouth.

The experimental work on galvanic action caused by metal fillings has been for the most part on cells composed of two dissimilar metals. In most cases, the values for the potential and the current of such cells have been measured by connecting wires to the metals and then to an electrical measuring instrument. Measurements have been made on actual restorations in the oral cavity, also on experimental cells.

It should be understood that the data obtained by either of these methods may not represent the conditions which are existent in the oral cavity. A determination of the potential which exists between two or among more metals in saliva gives only the information that the chemical behavior of the two metals in question is different when the metals are immersed in saliva. It does not follow that because a potential difference is measured, a battery exists, or that the presence of one metal will have any influence on the other when the two are not in direct contact.

A measurement of current flow between such metals in which the circuit is completed by wires attached to the metals, then to a microammeter, is likewise misleading. Such a circuit does not exist in the oral cavity. If current does flow between the two metals in the absence of the wires, one must postulate that the bony structure, tissue, blood stream or nerve tissue acts as an external circuit. However, it should be understood that the resistance of such a circuit would be many times greater than that of wires. The current that exists under actual conditions would therefore bear little relation to that measured experimentally.

Aside from the high resistance of such circuits, factors such as polarization and protective films will determine to a great extent how rapidly such a cell will operate. Furthermore, those investigators who base their contention that irritation cannot occur on the assumption that polarization will prevent such cells from operating must realize that such an assumption is likewise an admission that current was flowing for polarization to be established.

Although dissimilar metals not in contact have received most attention, it is not uncommon to find two or more dissimilar metals so placed in the oral cavity as to be in direct contact with or in close proximity to each other. Such a practice will most certainly be conducive to galvanic action, as will be demon-

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strated by experiments to be described later in this paper. Furthermore, there are conditions produced by single metal fillings which deserve more consideration and for which definite theories can be postulated. One has only to examine the surface and base of many amalgam fillings to observe corrosion, which is probably the result of galvanic action. Such amalgams need not be in contact with another metal or in mouths containing additional metal fillings. Corrosion on a single metal must therefore be considered where irritation is apparent. It is entirely possible that many cases of irritation traced to metal fillings, and thought to be caused by dissimilar metals, are the result of corrosion of the foregoing type, in which the patient is allergic to some one of the products of the cell on the surface of a single metal filling and not the result of electric currents believed to be flowing through the mouth.

We do not wish, and in fact are not qualified, to judge whether the irritation that has been reported is caused by any one of the foregoing conditions. If, however, it can be demonstrated that corrosion of metal fillings is serious and results from defects in design or lack of skill in making restorations, means for minimizing these defects are in order. It is the purpose of this work (1) to present experimental data on corrosion cells which may exist in the oral cavity, (2) to describe the conditions necessary for their operation, (3) to show the chemical products of such cells and (4) to present recommendations for the handling of metal fillings which will prevent the formation of such cells.

In the following experiments, corrosion resulting from contact between dissimilar metals and corrosion on the surface of a single metal filling will be demonstrated.

EXPERIMENTAL RESULTS

I. *Galvanic Cells in Which Dissimilar Metals Are Involved.*—It can be readily demonstrated that two metals not in contact and insoluble in saliva will have no influence on each other in the absence of an external circuit connecting the metals. In the following experiment, polished amalgam disks and plates of a dental gold alloy were carefully cleaned and suspended in a 1 per cent solution of sodium chloride in a small flask, by means of waxed thread. The metals were so arranged that contact with each other was impossible. No attempt was made to exclude oxygen from the flask. The metals were observed daily for signs of corrosion. At the end of one month, the amalgams had lost part of their original luster and, after six months, one of the amalgams developed two small blisters on the surface. No change could be observed in the gold at any time during the six-months' period. The above-mentioned experimental cell should be representa-

Fig. 1.—Corrosion occurring on amalgams placed in contact with plates of gold alloy and immersed in 1 per cent solution of sodium chloride. Severe corrosion has occurred where gold plates had been placed. Specimens 2 and 5 show the pitting that occurs with some types of corrosion.

tive of the example of two metals in the mouth not in contact if one assumes that the bony structure, tissues, etc., do not act as a connecting circuit. Theoretically, amalgam and gold should have no direct influence on each other in such a system, and, in the absence of other types of corrosion, both gold and amalgam should remain unattacked. Other experiments were made in which disks of amalgam alone were placed in the salt solution. As in the previous experiments, the only change observed was a gradual loss of luster, which was undoubtedly caused by the formation of a chloride or oxide layer over the surface of the amalgam.

If, however, the above-mentioned metals are placed in contact with or in close proximity to each other, for example separated by a liquid film, corrosion of one or both of the metals does occur. In dental practice, examples which fulfil the requirements for this type of galvanic action are (1) two metals connected by bridgework; (2) two metals in corresponding upper and lower teeth, and (3) two metals next to each other in adjacent teeth. The three following types of experiments were performed in connection with this type of corrosion.

A. The corrosion produced by intermittent contact between an amalgam and a dental gold alloy immersed in a salt solution was investigated. A polished amalgam disk and a plate of dental gold were so arranged in a 1 per cent solution of sodium chloride that contact between them could be periodically interrupted each minute. Corrosion of the amalgam began immediately and, after one week, the gold plate was tarnished, and had the appearance of gold which has come in contact with mercury. A white precipitate that did not adhere to the surface of the amalgam was later identified as a compound of tin. A potential difference of 515 millivolts was measured between the amalgam and gold alloy in the salt solution. Corrosion of two dissimilar metals in contact, for example, in corresponding upper and lower teeth, is therefore possible.

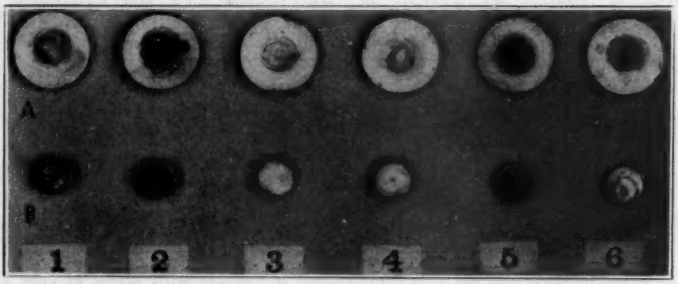

Fig. 2.—A, amalgam disks showing corrosion that occurred when they were placed in contact with gold alloys in dilute salt solution. There are small blisters on Specimen 1. B, gold disks that were placed in contact with amalgams. The tarnished areas are to be noted. Each of the disks was found to contain a small amount of mercury after being in contact with amalgam for six weeks.

B. Amalgams and dental gold alloys were placed in contact with each other in dilute salt solutions and in artificial saliva. In dental practice, this condition would be found if dissimilar metals were placed in contact; for example, bridgework in contact with an amalgam filling; or if dissimilar metal fillings were placed in close proximity to each other; for example, fillings opposite each other in adjacent teeth.

Four series of experiments were made

in which the following conditions were investigated: (1) the corrosion of amalgams of known but different compositions when placed in contact with gold alloys in dilute salt solutions, (2) the corrosion of "wet" and "dry" mixes of amalgams in contact with gold alloys in dilute salt solutions, (3) the potential difference existing between amalgams with known mercury content and gold alloys immersed in dilute salt solutions and (4) the corrosion of amalgams in contact with a gold alloy immersed in artificial saliva.

(1) In the first series of experiments, polished amalgam disks prepared from alloys of known composition were placed in contact with plates of dental gold in a 1 per cent solution of sodium chloride. Both metals were completely immersed. No attempt was made to exclude oxygen from the system. Corrosion began immediately on the surface of the amalgam. A white flocculent precipitate was formed. After approximately six months, the amalgams and gold were removed from the solution and examined. The amalgams were badly corroded (Fig. 1) and contained many pits, which were distributed at random over the surface. In some cases, pits were found on the side of the amalgam not in contact with the gold alloy. Corrosion was most severe on the amalgam at the points where the edges of the gold came in contact with the amalgam. In some cases, the area immediately under the gold plate was less corroded than any of the remaining amalgam surface. The gold plates were tarnished and had the appearance of having come in contact with mercury. Later, these plates were examined, and mercury was found in each. No attempt was made to determine the amount. The corrosion products were brushed from the gold and amalgam into the salt solution, which was analyzed for tin, silver and copper. The results of this analysis (for Experiments 1 to 8, inclusive) are given in Table 1. These data indicate that the chemical composition of the amalgam had some influence on the amount of corrosion, and that less tin and silver were removed from those alloys that were high in copper. Mercury could not be detected in the solution. However, it is possible that any mercury liberated amalgamated with the gold alloy.

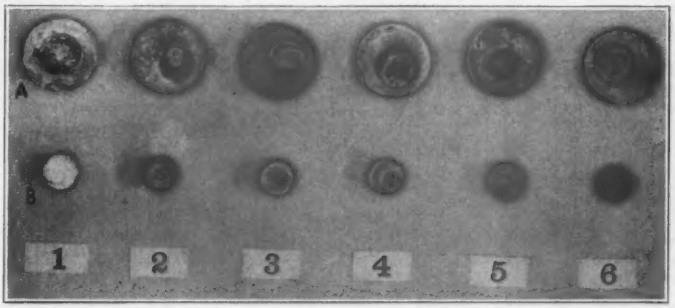

Fig. 3.—A, amalgam disks showing corrosion that occurred when they were placed in contact with gold alloys immersed in artificial saliva. There are blisters on Specimens 1 and 2. B, gold disks used with amalgams. Mercury was found in each of the tarnished gold disks.

(2) Because of the variations in amounts of tin and silver found in the corrosion products for alloys of different composition, a series of similar experiments were made in which both the mercury content and the composition of the amalgam were varied. Disks were

prepared from alloys of the compositions shown in Table 1, Experiments 9 to 18. Two disks were prepared from each type of alloy, one which was considered a "dry" mix, and one a "wet" mix (with a higher mercury content). The content of mercury was not determined. These disks were polished, cleaned and placed in contact with gold alloy in a 1 per cent solution of sodium chloride. Corrosion began immediately. After six weeks, the metals were removed and cleaned and the corrosion products were analyzed as before. The results of the analysis are given for Experiments 9 to 18, inclusive, in Table 1.

TABLE 1.—CHEMICAL ANALYSIS OF CORROSION PRODUCTS RESULTING FROM PLACING A ONE-INCH AMALGAM DISK IN CONTACT WITH GOLD ALLOYS* IN A ONE PER CENT SODIUM CHLORIDE SOLUTION

Experiment	Composition of Amalgam Alloy				Type of Mix Used in Preparing Amalgam	Duration of Experiment	Composition of Corrosion Products			
	Silver	Tin	Copper	Zinc			Silver	Tin	Copper	Zinc
	Per Cent	Per Cent	Per Cent	Per Cent		Weeks	Gm.	Gm.	Gm.	Gm.
1	68.2	26.7	5.0	0.05	Unknown	24	0.008	0.05	Trace	Trace
2	68.2	26.7	5.0	0.05	Unknown	24	0.010	0.05	Trace	Trace
3	68.3	26.0	4.7	1.0	Unknown	24	0.002	0.07	Trace	Trace
4	70.2	25.6	2.4	1.8	Unknown	24	None	0.03	Trace	Trace
5	70.2	25.6	2.4	1.8	Unknown	24	None	0.03	Trace	Trace
6	50.0	35.0	15.0	None	Unknown	24	Trace	0.003	0.015	Trace
7	50.0	30.0	15.0	5.0	Unknown	24	Trace	0.003	0.01	Trace
8	50.0	25.0	20.0	5.0	Unknown	24	Trace	0.001	0.005	Trace
9	67.8	26.6	4.5	1.1	Dry	6	Trace	0.03	Trace	Trace
10	67.8	26.6	4.5	1.1	Wet	6	Trace	0.03	Trace	†
11	71.5	25.5	0.2	2.7	Dry	6	Trace	0.01	†	Trace
12	71.5	25.5	0.2	2.7	Wet	6	Trace	0.01	†	Trace
13	70.2	25.6	2.4	1.8	Dry	6	Trace	0.03	Trace	Trace
14	70.2	25.6	2.4	1.8	Wet	6	Trace	0.04	Trace	Trace
15	68.2	26.7	5.0	0.05	Dry	6	Trace	0.04	Trace	†
16	68.2	26.7	5.0	0.05	Wet	6	Trace	0.05	Trace	†
17	74.3	25.0	None	0.6	Dry	6	Trace	0.03	†	†
18	74.3	25.0	None	0.6	Wet	6	Trace	0.08	†	†

*The chemical composition of the gold alloys used in all of the foregoing experiments was gold 78.0 per cent; silver, 10.0 per cent; platinum, 6.1 per cent, and copper, 5.9 per cent.
†No test made.

An inspection of the results in the above-mentioned table shows that the amount of corrosion varied for the different alloys. However, any correlation between the chemical composition of the modern alloy (tin 26-28 per cent, silver 68-74 per cent, copper 0-4 per cent and zinc 0-2 per cent) and the mercury content and the amount of corrosion is not justified. The amounts of silver and copper removed were so small that they are recorded as traces. Traces of zinc were found in most instances.

The small amounts of copper and zinc found can be accounted for on the following basis. An amalgam prepared from an alloy containing 4 per cent of copper and 1 per cent of zinc will have approximately 2 per cent of copper and 0.5 per cent of zinc. Each amalgam disk weighed approximately 6 gm. and contained a total of 0.12 gm. of copper and 0.03 gm. of zinc. The total amount of corroded material was small and the greater part was tin. Unless all of the copper and zinc in an amalgam speci-

men were removed by corrosion, there could be only traces of zinc and copper in the solution containing the corrosion products. The small amounts of silver found cannot be explained on this basis, and one must assume, as would be expected, that tin is removed from the amalgam in preference to silver.

(3) A third series of experiments were made to determine whether a pronounced difference in potential exists between a gold alloy and amalgams prepared from alloys of known but different composition and having a definite content of mercury. Alloys with the compositions given in Table 2 were used. Weighed portions of the alloy and mercury were used for each mix. Mixing was done in a mechanical amalgamator. The disks were formed in a steel die placed in a compressional testing machine, under loads of 2,000, 4,000 and 6,000 pounds. The mercury expelled was recovered and weighed.

The disks were polished and mounted in a glass cell containing a 1 per cent solution of sodium chloride and a dental gold alloy. The cell was so arranged that potentials could be measured between the amalgams and the gold alloy. The data from these measurements are given in Table 2. These data indicate that the differences in potentials for the various amalgam specimens were not of sufficient magnitude to make possible any correlation of alloy composition, mercury content and potential. Factors such as surface of the amalgam electrodes and strain in all probability cause greater variations in the potentials than are caused by the small differences in composition of the alloy.

After the foregoing data were obtained, the amalgam and the gold alloy disks were placed in contact with each other in the salt solution for a period of six weeks, after which they were removed and their surfaces examined. Both the amalgam and the gold alloys were tarnished. Small blisters were observed

TABLE 2.—POTENTIALS OF COMBINATIONS OF AMALGAMS AND A DENTAL GOLD ALLOY IN A 1 PER CENT SODIUM CHLORIDE SOLUTION

Experiment	Composition of Amalgam Alloy				Data on Preparation of Amalgam Disk Using Mechanical Amalgamator (15 Seconds in the Amalgamator)			Potentials of Combinations of Amalgam and Gold
	Silver	Tin	Copper	Zinc	Weight of Alloy Used per 160 Gm. of Mercury	Load Applied for 5 Minutes	Weight of Excess Mercury Removed	Amalgam* Vs. Gold†
	Per Cent	Per Cent	Per Cent	Per Cent	Gm.	Pounds	Gm.	Millivolts
1	71.6	25.5	0.2	2.7	106.4	4,000	88	512
2	71.6	25.5	0.2	2.7	106.4	6,000	91	530
3	68.0	26.5	4.5	1.0	120.0	4,000	56	497
4	68.0	26.5	4.5	1.0	120.0	4,000	57	445
5	74.3	25.0	None	0.6	120.0	6,000	69	542
6	74.3	25.0	None	0.6	120.0	6,000	68	531
7	68.2	26.7	5.0	None	120.0	6,000	63	490
8	71.6	25.5	0.2	2.7	106.4	6,000	89	539
9	71.6	25.5	0.2	2.7	106.4	6 000	90	548

*Amalgam was always anodic to gold alloy.

†Gold alloy having the following composition was used: gold, 78.0 per cent; silver, 10 per cent; platinum, 6.1 per cent, and copper, 5.9 per cent.

on the surface of some of the amalgams, and mercury was found in the gold disks. The surfaces of both the amalgam and the gold disks are illustrated in Figure 2.

(4) In a fourth series of experiments, polished amalgam disks prepared as described above were placed in contact with polished disks of a gold alloy in an artificial saliva. The following formula used in compounding the saliva is the same as that employed by Greenwood, Down and Worner.[33]

Potassium chloride	2.4 gm.
Tricalcium phosphate	0.6 gm.
Potassium sulfate	0.9 gm.
Dipotassium phosphate	1.4 gm.
Trisodium phosphate	0.8 gm.
Albumen	5.0 gm.
Distilled water	1 liter

the physical properties of the gold appliance and amalgam filling.

C. A third type of experiment was made to determine whether corrosion would be as severe between a tarnished amalgam and a polished gold alloy as between polished specimens of both metals. Two disks of amalgam were prepared from the same alloy. Both disks were polished and one was then tarnished by subjecting it to a moist atmosphere of hydrogen sulfide. Both specimens were then placed in contact with polished gold plates and immersed in a 1 per cent solution of sodium chloride. One month later, the amalgam and the gold were taken from the salt solutions and any loosely adhering corrosion

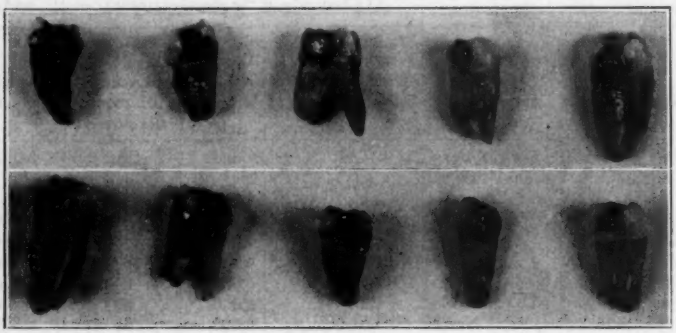

Fig. 4.—Amalgam fillings having tarnished and polished areas on surface. There are evidences of failure to seal the cavity as well as to polish certain areas.

Corrosion of the amalgam disks began immediately and, as in the previous experiments, their surfaces became pitted. The gold disks were discolored and contained mercury. The tarnish and corrosion on both the amalgam and gold disks are illustrated in Figure 3.

These experiments demonstrated that if dissimilar metals are placed in contact with each other, corrosion, in which the less noble metal is dissolved, is likely to occur. Even in the absence of galvanic action, gold alloys in contact with amalgam may remove mercury from the amalgam. This may materially change

products were removed by gentle brushing with a toothbrush. The solutions containing the corrosion products were analyzed. The analysis of the solution in which polished amalgam and gold were placed gave 0.001 gm. of tin and traces of silver and zinc. The solution in which tarnished amalgam and polished gold plate were placed contained 0.006 gm. of tin and traces of silver and zinc. Copper was not present in the original alloy from which the amalgam specimens were prepared. The foregoing experiment indicates that tarnishing of the amalgam does not prevent galvanic action

and may actually cause greater corrosion.

II. *Corrosion in a Single Metal Restoration.*—Three types of corrosion may occur in a single metal restoration in the absence of additional or dissimilar metal fillings. The metal may dissolve in the oral fluids, may tarnish or may become pitted as a result of the formation of anodic and cathodic areas on the surface.

A. Solution: Corrosion in which the surface is uniformly attacked and dissolved by oral fluids will give the metal surface an etched appearance. The color of the metal usually remains unchanged, provided the corrosion products formed

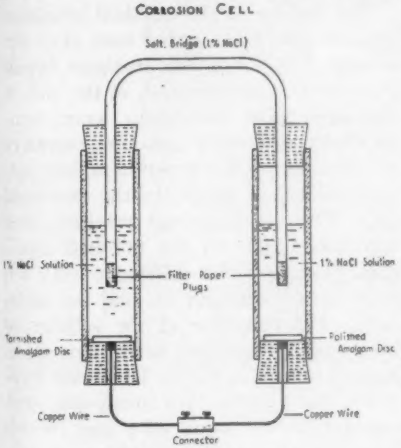

Fig. 5.—Corrosion cell.

are soluble or do not adhere to the surface. This type of attack is responsible for the metallic taste experienced after the insertion of a metal filling or after ingestion of acid foods. If this corrosion were severe, the filling would rapidly disappear. This, however, is not the case, as amalgam fillings are known to retain their surface contours for long periods of time.

B. Tarnishing: Attack of a metal filling with formation of insoluble corrosion products which are tenaciously held on the surface of the metal is responsible for tarnishing in dental restorations.

All amalgam fillings tarnish to some extent in the oral cavity, and any investigation of a large number of such fillings will reveal that some amalgams are more severely tarnished than others. A study of the amalgams now on the market will show little difference in chemical composition. It is therefore doubtful whether the amount of tarnish observed in different mouths or in the same mouth can be accounted for by variations in composition. The personal habits of the patient may account for some of the differences observed, but it is doubtful whether these habits can be responsible for the tarnish and corrosion that are at the base of many amalgam restorations. Other factors must, therefore, be involved.

Tarnish on amalgams may actually prevent their further corrosion provided the surface is uniformly and completely covered. However, it may be the cause of severe pitting of the surface if non-uniform spots are developed (anodic and cathodic areas) between two or more points on the metal. Non-uniformity of the protective coating produces such areas. A number of excellent examples of this type of attack were found when fifty freshly extracted teeth containing amalgam fillings were examined. In those teeth in which the amalgam extended from the occlusal to the gingival areas, tarnish was always found on the gingival surface and less often on the occlusal surface. This was particularly true in those cases in which there was evidence that the gingival area had not been polished or that the amalgam was not placed in such a manner as to be self-cleansing or easily cleaned by brushing of the teeth. Examples of this tarnished condition are shown in Figure 4.

The following experiment was performed to demonstrate the corrosion which is likely to occur in such a restoration. Two amalgam disks (Nos. 9 and 10, Table 1), approximately 1 inch in diameter and one-eighth inch thick,

were prepared from a commercial dental alloy. Weighed portions of the alloy and mercury were mixed in a mechanical amalgamator. The mix was pressed into a disk in a die placed in a compressional testing machine. A constant load was applied for a given length of time. The mercury which exuded during pressing was caught and weighed. Both disks were polished as nearly alike as possible with emery paper. The disks were then mounted in a cell (Fig. 5) in such a manner that the potential between the two disks could be measured. This potential was found to be 9 millivolts in a 1 per cent solution of sodium chloride. The two disks were then connected by means

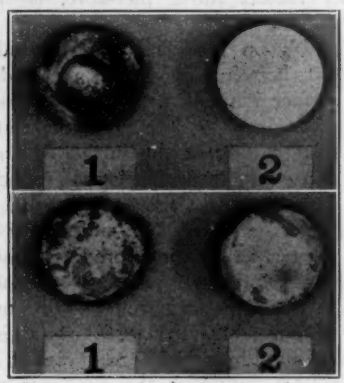

Fig. 6.—Above: 1, tarnished amalgam before experiment; 2, polished amalgam before experiment. Below: 1, tarnished amalgam after experiment; 2, polished amalgam after experiment.

of the external copper wires and permitted to remain connected for from sixteen to twenty-four hours of each day. This procedure was repeated daily for ten days. No corrosion was observed. (The copper wires shown in Figure 5 were sealed into the amalgam disk and then embedded in wax in order to prevent either the wires or the seal from coming in contact with the salt solution.) The amalgams were removed from the above-mentioned cell and one of them was tarnished by being placed in contact with a plate of dental gold immersed in a 1 per cent sodium chloride solution. The other disk was placed in distilled water in a closed container. At the end of one month, the tarnished disk and the polished disk were mounted in the two arms of the cell (Fig. 5) in the same manner as in the foregoing experiment. The potential difference, measured on the first day, of 20 millivolts increased over a period of six days to a value of 90 millivolts. The polished amalgam was anodic to the tarnished disk. During this time, the polished amalgam lost some of its luster.

The surface of the polished amalgam was not severely corroded until after the seventh day. Then the amalgam began to evidence corrosion and, at the end of ten days, both amalgams were completely covered with corrosion products. At the start of this experiment, the polished disk was anodic to the tarnished disk. This condition was reversed after corrosion began on the polished amalgam. The potential difference after ten days varied between 10 and 20 millivolts. The condition of the surfaces of both disks before and after the experiment is shown in Figure 6. In the foregoing experiment, two amalgams, prepared from the same alloy and treated alike except for the tarnishing of one, were severely corroded when placed in contact. Any placing or treatment of amalgam fillings, therefore, that presents some surfaces that are easily tarnished and others that are not readily tarnished is conducive to the formation of anodic and cathodic areas.

C. Pitting: Corrosion in which the surface is pitted is the most serious type of attack that can occur on a single amalgam filling. The area involved may be relatively small or may be at the base of the amalgam or just beneath the margins. Corrosion of this type is usually severe and may materially decrease the strength of the restoration through

solution of a large amount of material from a small area. In dental practice, at least three conditions exist which are conducive to the formation of such cells: 1. The amalgams may fail to seal the cavity. 2. They may have tarnished areas as described in the previous section. 3. They may have been improperly mixed or condensed.

base. (Fig. 7.) In most cases, more than mere tarnish was involved. Often, the filling was definitely pitted and, in some cases, corrosion was so severe that the amalgam had apparently lost much of its strength and could be crumbled between the fingers. Furthermore, in all the teeth in which leakage was apparent, the walls of the cavity immediately surrounding

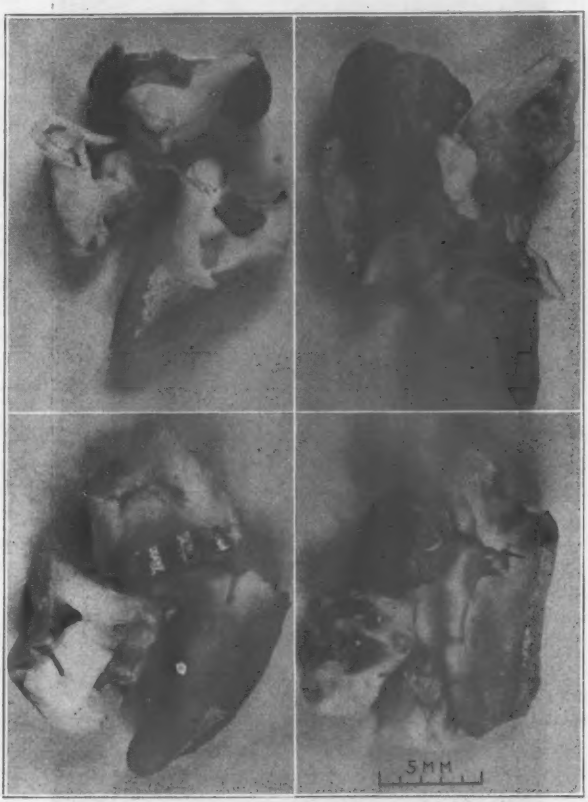

Fig. 7.—Tarnished and corroded amalgams and sections of cracked teeth from which amalgams were removed. The tarnish on the amalgam and the discolored condition of the cavity walls and tooth are to be noted.

Forty or fifty freshly extracted teeth containing amalgam fillings were crushed and examined for this type of corrosion. In all the teeth in which the filling failed to seal the cavity, evidence of corrosion was observed along the sides and at the the filling were discolored. This discoloration often extended into the dentin as far as the pulp chamber. (Fig. 8.)

An effort was made to determine whether the discolored areas immediately surrounding the filling and those extend-

ing deep into the dentin contained corrosion products of the amalgam. In the first of these experiments, the amalgams were removed from the teeth by immersion in liquid air for a few minutes, then in hot water. Under this procedure, the tooth cracked away from the amalgam. The tooth sections were examined under a microscope for the presence of any metallic particles that might have been retained. When a spectrochemical examination was made of material removed from the discolored area of the tooth that formed the cavity walls, tin, copper, zinc and silver were found.

In a second series of experiments, sections of the discolored area extending deep into the dentin were removed with a dental drill and examined spectrochemically. Tin, copper, zinc and silver were found. It was not possible to say from this examination that the concentration of the foregoing metals in the discolored area near the pulp chamber

Fig. 8.—Cross-section of teeth containing amalgam fillings that evidence failure to seal cavity. The black areas around the edges of the filling and the dark areas on the dentin below the amalgams are to be noted.

was greater than that of the very minute quantities normally found in that area of the tooth. The possibility that the discoloration was caused by a previous treatment of the cavity with silver nitrate was made less likely by the fact that only traces of silver were found in the drillings. However, the concentration of the metals in the portion of the tooth that immediately surrounded the filling and the condition of the filling left no doubt that corrosion had occurred. Amalgams are subject to destruction if they fail to seal the cavities. It is possible that the failure of an amalgam to retain its margin may be accounted for by corrosion and pitting immediately below its marginal surface.

A second condition favorable for corrosion and pitting is that of a restoration in which the amalgam has not been properly mixed or condensed. The surface of such a filling is not homogeneous and areas may be present which are attacked more readily than the surrounding metal. Such non-uniform areas can dissolve electrolytically and form pits or craters. This attack may cease after the removal of the more soluble constituent, or may result in more serious attack through the formation of anodic and cathodic areas. The presence on the surface of an amalgam of any pit or crevice that can retain food particles is, therefore, a possible source of trouble.

The third possible cause of pitting is the formation of anodic and cathodic areas from partial tarnishing of the surface. This type of corrosion has been discussed in the section on tarnishing.

Galvanic action on a single metal filling may also result from exposure of different areas of the filling to solutions that are not chemically the same. Such a condition produces a simple concentration cell, which in dental practice would be found where an amalgam restoration fails to seal the cavity. The base of such an amalgam would be exposed to a solution of a different concentration, for example of oxygen, from that in contact with the surface. Likewise, deep cavities containing large amalgam fillings that have not been sufficiently protected may develop such anodic and cathodic areas because of wetting of the base of the amalgam by fluids contained in the dentin portion of the tooth near the pulp chamber. Such fluids are undoubtedly different from saliva. There need be no failure to seal the cavity for this type of cell action to occur.

SUMMARY

1. Corrosion cells can occur in either single metal restorations or between dissimilar metal restorations.

2. Laboratory experiments show that severe corrosion occurs when amalgams are placed in contact with gold alloys in either dilute salt solutions or in artificial saliva, or when corroded amalgams come in contact with polished amalgams immersed in salt solutions. Both pitting and tarnishing of the amalgam surfaces were observed in these experiments.

3. Chemical analysis of the corrosion products formed in the foregoing experiments showed that tin was the major constituent.

4. Potential differences, in a dilute salt solution, were measured between a dental gold alloy and amalgams prepared from alloys having different compositions and different contents of mercury. The potential values obtained varied between 445 and 548 millivolts. The amalgam was always anodic to the gold, but no correlation was possible between the composition of the alloy, the mercury content and the potential measured.

5. Previous tarnishing of an amalgam did not prevent its further corrosion if it came in contact with a gold alloy in a dilute salt solution.

6. In fifty freshly extracted teeth containing amalgam fillings that were examined, corrosion was observed at the base of the amalgam in all in which the filling evidently failed to seal the cavity.

The tooth structure was discolored beneath these fillings. A spectrochemical examination of those discolored areas revealed the presence of tin, copper, zinc and silver. Tarnish of the amalgams was found to be more serious in those areas where polishing was not done at the time of insertion.

CONCLUSIONS

Adoption of the following suggestions is essential in the handling of metal fillings, particularly amalgam, if corrosion and the formation of corrosion cells are to be prevented in dental practice.

1. Amalgamation must be thorough and must incorporate every particle during trituration in order that a homogeneous amalgam shall result.

2. Condensation should be such that there will be no crevices and cracks and a homogeneous surface will be obtained.

3. The filling must be polished as soon as it is hard enough to retain a polish and must be kept polished.

4. Fillings should be contoured to be self-cleansing or should be placed in such a manner as to be readily cleaned by brushing.

5. Dissimilar metals in contact constitute a hazard and should be examined for evidences of corrosion.

6. Amalgam must be so placed that the cavity is completely sealed if corrosion and tarnish at its base are to be prevented.

7. In those cases in which metallic restorations are suspected to be the cause of irritation, the filling should be inspected for corrosion, and any conditions that are favorable to corrosion should be removed.

8. The possibility that the patient may be allergic to metal ions formed from corrosion cells should be considered whenever disturbances are thought to arise from the presence of dissimilar metals or from a corroding amalgam.

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USE OF GERMICIDES IN MODERN ASEPTIC TECHNIC

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STERILIZATION means the complete destruction of all bacteria, regardless of the method used. While this procedure is usually associated with the use of heat supplied by a steam autoclave or by boiling, the use of cold sterilization by means of germicides is of as great importance in modern aseptic technic. In the past few years, the adequacy and effectiveness of the germicides employed for sterilization have been questioned. Further examination of the problem, however, shows that considerable advance has been made recently in the type of germicides available. At present, many studies are in progress in an attempt to improve further the methods of cold sterilization and to adapt its economy, convenience and safety for everyday practical use. The question is not whether cold sterilization in its scope is adequate for an aseptic surgical technic. Cold sterilization is being used by both the dental and the medical profession with safety and efficiency. The real question confronting the professions is a better knowledge of the germicides and a definite procedure in cold sterilization.

The use of disinfectants dates back to 1867, when the great English surgeon Joseph Lister brought out the value of disinfectants in maintaining asepsis. Lister checked the ravages of wound infection by introducing the antiseptic system that bears his name. While the present methods have been modified, the principles that Lister established are still adhered to, and they form an important link in the chain of asepsis in successful surgical procedure. If we eliminate the use of disinfectants from

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the surgical technic, the treatment of wounds would revert to the problems of combating infections that confronted the medical professions before 1867. It was the discovery of asepsis by the use of disinfectants, and not by the destruction of bacteria by heat, that made surgical operations safe.

STERILIZATION PROCEDURES

An essential factor in sterilization is the destruction of infectious organisms regardless of the method used. The fact that material has been boiled, autoclaved or subjected to the action of a germicide may not insure sterilization. A definitely prescribed plan must be followed step by step if sterilization is to be obtained. This point is effectively demonstrated by some experiments which I have had my class in bacteriology perform each year. The experiments are as follows:

1. The entire class (about sixty-four students) obtain pure 72-hour cultures in nutrient broth of *Bacillus subtilis*. In place of surgical instruments, large metal wood screws serve for this experiment.

2. The screws are immersed in the broth culture of *Bacillus subtilis* for ten minutes, after which they are removed and permitted to dry in petri dishes.

3. Three separate periods were used for the experiments.

(a) Period A. The class performed the following procedures: The dried screws were placed in a 1:1,000 alcoholic-aqueous solution of phenylmercuric nitrate and allowed to remain for periods of from thirty seconds to two minutes. The screws were rinsed in sterile distilled water to remove the germicide. Thereafter, the screws were cultured in nutrient broth and incubated for forty-eight hours. The total incubation period was two weeks. Approximately 50 per cent of the cultures were positive.

(b) Period B. The class placed the dried screws in a boiling water-bath and left them for thirty minutes. After forty-eight-hours incubation, most of the cultures were positive for *Bacillus subtilis*.

(c) Period C. The class thoroughly washed the screws with soap and running water and placed them in a 1:1,000 phenylmercuric nitrate isopropanol-aqueous solution and allowed them to remain for ten minutes. The screws were rinsed in sterile water and incubated for two weeks and not a single positive culture was obtained. Negative cultures were also obtained from the sterile water in which the students rinsed the screws.

Such experiments emphasize the fact that adequate sterilization of surgical and dental instruments can be obtained provided all blood, débris and as many germs as possible are first removed mechanically by thorough scrubbing with soap and water followed by rinsing before subjection to the germicide.

GERMICIDAL SOLUTIONS

Several facts must be considered if a germicidal solution is to be successfully and efficiently employed. First, care must be used to employ the germicide in proper concentration in the solution. The germicidal power of a chemical naturally differs according to its concentration, each agent having a possible concentration which assures the maximum and most rapid bactericidal action. Secondly, the chemical composition of the particular germicide used is very important. Numerous germicides now sold are unsatisfactory, since they have an offensive odor, involve difficulty in application, have a narrow range of effectiveness, have corrosive qualities and lose bactericidal power in the presence of tissues, blood or pus. In the past few years, chemotherapy has developed agents devoid of these undesirable properties. Buffer agents have been added to make the solution non-corrosive, as well as wetting agents to effect greater

penetration. Such agents as phenylmercuric nitrate, merthiolate and metaphen possess high germicidal action and are relatively non-toxic to animals whether given orally, subcutaneously or intraperitoneally.

A third factor to be considered in sterilization is the nature and condition of the material to be treated. Any attempt to sterilize instruments containing blood or pus without preliminary mechanical cleansing is poor technic. Blood, pus or débris hinders the penetration of the germicide into the bacteria, and, moreover, the larger number of bacteria, which could be eliminated by proper scrubbing, requires prolonged sterilization when germicides are used.

Time is an all-important factor in proper sterilization. Some bacteria are destroyed in a few seconds, while others, especially those that form spores, require prolonged cold sterilization, sterilization under pressure or intermittent sterilization with germicides. It would require more than an hour to bring about sterilization by boiling. In dealing with these resistant encapsulated organisms, it has been demonstrated that the intermittent method of cold sterilization is just as effective and more convenient than the intermittent use of heat. For the destruction of the vegetative form of bacteria, at least ten to twenty minutes is required when solutions of metaphen, merthiolate or phenylmercuric nitrate are used. Although infection from spores by way of contaminated surgical instruments is practically unheard of, if spores may be present, intermittent cold sterilization may be employed. The use of more than one solution in this procedure is effective, employing first a solution such as formaldehyde, and later a mercury preparation. Fortunately, the vast majority of professional offices are too clean to harbor pathogenic spore-forming bacteria, which are usually an evidence of lack of ordinary sanitary procedures.

PRACTICAL USES OF GERMICIDES

Skin Disinfection for Surgical Procedures.—Every one recognizes the necessity for thorough sterilization of the hands and forearms after contamination with infected material, and, more especially, previous to operative procedures, in order to maintain asepsis. The accepted procedures of scrubbing the hands, fingernails and forearms with a stiff brush, then thoroughly rinsing in running water is followed. The hands and forearms are rinsed and immersed in a 70 per cent solution of alcohol for three minutes. The latter step is the one usually omitted, since a dip in the alcohol solution satisfies most operators. Better results can be obtained by using a 1:1,000 phenylmercuric nitrate in a 60 per cent aqueous-isopropanol solution or a 1:1,000 phenylmercuric nitrate in a 70 per cent aqueous-alcohol solution for one-half this period. These solutions are inexpensive and disinfectant, while, at best, solutions of alcohol alone are only antiseptic. Where it is unpractical to scrub the hands for longer than a minute or so, as in the case of the dentist between seeing patients, either of the two mercury solutions above mentioned are suited for fairly rapid disinfection of the hands. If desired, a less concentrated solution of phenylmercuric nitrate can be used. It is listed as having the power to kill *Staphylococcus aureus* in a dilution of 1:192,000 after ten minutes. It is inconsistent to sterilize polished instruments and materials in the autoclave if the hands remain contaminated.

Disinfection of Operative Fields.—The field of operation may be contaminated with virulent pathogenic organisms, which may be carried into the depths of the incision. Before the introduction of antiseptic methods by Joseph Lister, nearly every wound or surgical incision became a running sore, discharging pus. The most conspicuous feature of modern surgical practice is the scrupulous care

taken to avoid the infection of the operative wound. This step in the chain of asepsis would be impossible without the use of germicides. The present method of scrubbing the operative field with soap, rinsing well with 70 per cent alcohol, and then making two applications of tincture of iodine, U.S.P., followed by removal of excess iodine with 70 per cent alcohol may well be improved by the use of effective germicides. Speaking of the virtues of phenylmercuric nitrate, G. B. Athy, M.D., writes:

> An alcohol-acetone-aqueous 0.034% solution of Phenylmercuric Nitrate with Orange G. added for coloring agent gives complete disinfection of unwashed human skin in 96% of the cases after three minutes' contact with the infected skin. Mercurochrome gave 8% disinfection, tincture of iodine 84% and Metaphen 92%.

The use of a colorless solution of phenylmercuric nitrate 1:1,000 in a 60 per cent isopropanol-aqueous solution is suggested for rinsing off the soap and water in the foregoing procedure previous to the application of a colored phenylmercuric nitrate solution, recommended by Dr. Athy.

Maintenance of Sterile Ligatures and Sutures.—Phenylmercuric nitrate 1:5,000 solution in a 70 per cent alcoholic-aqueous solution serves as an excellent germicidal preparation for keeping sutures sterile. Metaphen or merthiolate may be used for the same purpose. Since merthiolate has been extensively used in the preservation of biologic preparations, there should be no objection to the adaptation of non-toxic germicidal solutions for the preservation of suture material, with the added convenience of always having sterile sutures ready for use.

Sterilization of Sharp Surgical Instruments and Dental Cutting Instruments.—Cutting instruments should be thoroughly cleansed first, by soap and water, and rinsed and immediately placed in the germicidal solution. While many depend on heat, either by autoclaving or by boiling, for sterilization of delicate sharp knives, heating destroys the fine temper of the steel or metal alloy used and increases metallic oxidative processes. If properly buffered germicidal solutions are employed, corrosion will not take place, and sterile sharp and polished instruments are assured. Sterilized instruments may be removed directly from the solution for operative use, or they may be wrapped in sterile towels or gauze. Cleansed surgical instruments require a twenty minutes' or longer submersion in the disinfecting solution to insure adequate sterilization.

Instruments with Movable Parts.—Contra-angle handpieces and other instruments with movable parts are successfully disinfected in a specially prepared oily base containing 1:1,000 phenylmercuric nitrate. The solution is non-corrosive and instruments may be left in the solution until needed, thus insuring that the parts will be freely movable and lubricated with a disinfecting oil.

Other Instruments and Accessories.—Cold sterilization is also suitable for such highly polished instruments as dental forceps, scissors, mirrors, hemostats and other of the usual instruments required for surgical or dental procedures. These instruments may be taken directly from the solution for imediate use, to avoid extraneous contamination. There is advantage in having the beaks of the forceps wet with a non-irritating solution when they are used to pry deeply around the margin of a tooth in the process of extraction.

Sterilization of Cavity Preparations.—Prepared cavities should be disinfected before fillings are placed because decay is essentially an infectious disease and penetrates deeper than the finished cavity. There are myriads of bac-

teria present in decayed material. Numerous germicides have been used for disinfecting the prepared cavity. Phenol, perhaps the most extensively used for this purpose, has numerous disadvantages. It has a corrosive action and is dangerous when applied to soft tissues, serious tissue burns resulting. However, phenol is an efficient germicide. The use of phenylmercuric nitrate 1:1,000 in a solution of 50 per cent alcohol, 10 per cent acetone and 40 per cent water offers many advantages in disinfecting cavity preparations. This solution disinfects the prepared cavity without excessive dehydration. It can be used to disinfect (1) cavities prepared for gold foil fillings; (2) the tooth and investing tissues, without irritation; (3) the tooth and rubber dam in root-canal work, and, finally, with the utmost success, (4) tissues, before needle insertions and before extractions.

Needles. — Hypodermic and suture needles require great care. They must be sharp and free from rust spots. After washing, some of the germicidal solution should be forced through the needle before it is placed in the solution. Previous to use, the needles should be rinsed in sterile distilled water and washed out by again forcing the water through the needle.

Syringes.—Boiling of glass syringes in other than distilled water soon leads to the deposition of alkaline materials on the walls of the syringe. If it is necessary to use a glass syringe several times a day, the life of the syringe can be prolonged by immersion, for a sufficient period, in a germicidal solution, and by rinsing in distilled sterile water just before use. If the carpule type of syringe is used, the syringe is loaded with the carpule and sterilized and the sterile needle placed in the syringe just before use. This type of syringe may be used directly from the solution without rinsing in distilled water.

Clinical Thermometers.—After rinsing under cold water, thermometers are usually sterilized by the cold method in a solution of phenol or a 1:2,000 solution of mercuric chloride, or by volatile fumes of formaldehyde from a saturated bit of cotton placed in the bottom of the thermometer case. These solutions are objectionable and the formaldehyde soon evaporates to dryness. Phenylmercuric nitrate has a much higher phenol coefficient than mercuric chloride and it has a low toxicity. A 1:1,000 solution of phenylmercuric nitrate in a 70 per cent alcoholic-aqueous solution is most desirable and effective for sterilization of these accessories.

CONCLUSIONS

I have endeavored to bring out some of the practical applications of cold sterilization in modern use. Stress has been placed upon procedure for sterilization, especially upon the thorough cleansing of the instruments with soap and water before any attempt is made to bring about sterilization. There is no single method of sterilization that will cover the entire field of aseptic surgical technic. Materials such as sponges, dressings, towels and other similar materials should be sterilized in the autoclave or by heat. Disinfectants can be and are being successfully used for skin disinfection for surgical procedures; disinfection of operative fields; maintenance of sterility of ligatures and sutures; sterilization of sharp surgical instruments and dental cutting instruments, instruments with movable parts and other highly polished instruments and accessories; disinfection of prepared cavities, and sterilization of needles, syringes and clinical thermometers.

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VINCENT'S INFECTION?

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THOSE of us who were practicing dentistry during, and for several years after, the first World War do not need to be reminded of the symptoms of one of the worst forms of ulcerative gingivitis, Vincent's infection, to recall the picture in all of its ghastly aspects. Nor is it necessary to review the endless list of drugs and procedures employed to combat this scourge, in order to recall the seemingly hopeless task of making the victim safe for society.

Those of us who began practice about the middle of the third decade have seen the scars of the havoc wrought and of course have seen more or less typical cases of this disease. Nevertheless, we cannot appreciate to the fullest extent the magnitude and seriousness of the problem that faced our predecessors. By this observation, I am not advancing the idea that Vincent's infection is no longer a menace or that it has been rendered innocuous through the efforts of the bacteriologist. I merely wish to warn against any attitude of contempt for this disease, which may arise with an easy victory over latter-day cases, victory made possible by the experience of older men. Particularly at this time, when there is every prospect of a repetition of the very conditions existent during the first World War, we should not only be informed, but also be alert to the possibility of a devastating flare-up, which almost certainly will come to contribute in large measure to the various kinds of inefficiency in this nation's preparedness program. This responsibility is strictly in the hands of the dental profession; for it has been demonstrated time and again that the medical practitioner's armamentarium and method of attack not only are ineffective, but also, next to pure neglect, constitute one of the surest means of causing an acute to become a chronic condition, which under conditions of military life becomes well nigh incurable.

For purposes of orientation, let us consider the first World War period and the status of information on ulcerative gingivitis, which later was to be called Vincent's infection. The condition was then not new to the profession; in fact, the lesion in milder form had been observed for many years. Its etiology, however, was obscure and its treatment necessarily empiric. Little was known about the effect of diet one way or another. Balanced diets, so-called, "balanced" referring to the proportion of protein, carbohydrates and fats, were being widely investigated and claims advanced. The existence of chemical complexes, now called vitamins, was totally unsuspected outside the field of chemistry, as also, naturally, was the possibility of disturbances due to their deficiency. The internal glands were suspected of elaborating substances of some order, and some investigators claimed to have demonstrated the contributions of the glands to the blood stream, but evidence of this was not generally accepted, to say nothing of their now well-known interrelationship and specific effects upon various tissues.

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An instance is the effect of the sex harmone upon gingival tissue, as evidenced in pregnancy, by experimentation and by therapy.

Koch's postulates were, by the beginning of this century, well tried and had been found dependable. Medical thought and concept were based largely on bacteriologic findings. A kind of throat infection had, according to such concepts, long been designated as Vincent's angina, and two organisms, a spirochete and a fusiformis, had been discovered in association with it and, therefore, were considered responsible for this condition. It was suspected that possibly these organisms were responsible for the oral condition of extreme ulceration, especially when the general symptoms were similar and the mouth yielded these two organisms in abundance. The evidence was so apparent that we have come to accept it, and we have revised our nomenclature accordingly. For years, we have been regarding this well-known syndrome as an anterior extension of the throat infection, Vincent's angina, to the gingivae, calling it Vincent's infection to differentiate the two lesions.

Just criticism of this action is that it was perhaps a little hasty, as the oral spirochete and *Fusiformis dentium* are not only difficult to isolate, but also defy our best efforts at culturing; to say nothing about non-conformity with Koch's postulates. Furthermore, it is now well known that, in the mouth, there are several varieties of spirochete and fusiformis, whose structure and condition of symbiosis are not understood. With the present information, how can a smear examination of material from any location in the mouth have diagnostic value?

Substantiating this challenge is the fact that not only is it almost impossible to secure a negative smear after treatment, with apparent disappearance of the symptoms, but also mouths that show none of the symptoms may yield positive smears. Argument that a certain definite percentage of these organisms must be present in the mass of oral flora for a positive diagnosis is not well supported.

Those of us in this work who have had the opportunity to make smears and stain and examine them, day in and day out for the past twenty to twenty-five years, can scarcely fail to agree that the proportion depends on the degree of salivary dilution; on the amount of time elapsing after treatment; on brushing, eating, drinking and reflex swallowing, and on the technic of making the smears. Moreover, even these factors are variable, and, to make the slide examination more ludicrous, who among us is able to identify micro-organisms by morphologic characteristics? Seemingly, a negative smear admits of only one practicable interpretation: the material either came from an area recently treated or cleansed or it was carelessly obtained. This discovery is a disappointment to practitioners and investigators alike, but in no sense can it be regarded as indicative of failure. As a method of quick diagnosis, it was gratifying to both dentist and patient, and its employment during the past years has resulted as a contribution to knowledge of the condition, for, in scientific progress, it is just as important to establish negative facts as positive ones.

In a review and summary of progress, we can say that Vincent's infection assumes both an acute and a chronic form, that the acute form if allowed to run its course becomes chronic and that the chronic form may become acute. We know that a patient presenting either form requires nearly the same treatment and home care. We know that the acute form is more easily brought under control and that the symptoms disappear rapidly and apparently completely. Chronic Vincent's infection, on the other

hand, is exceedingly stubborn and requires exhaustive treatment and the closest kind of cooperation on the part of the patient. Even then recurrences are to be expected.

We know that unless the acute form is treated early, it can cause extensive destruction of the gingivae and alveolar bone and it lays the foundation for pyorrhea. Furthermore, we know that topical application of specifics to the gingival surfaces is practically worthless since the drugs do not reach the protected viable organisms deep in the pockets. Acute cases so treated almost certainly progress to the chronic stage, and apparently make the transition more quickly than when untreated. We know that recurrent Vincent's infection must be handled as if it were a primary infection, and although it may be localized, the entire gingivae must be subjected to medication. We know, or at least some of us think, that even correct handling of these cases results in elimination of the signs and symptoms, but does not eliminate the organisms. They are merely reduced in virulency to such degree that tissue resistance is able to keep them in subjection and they become normal inhabitants of the mouth, if indeed they were not present in the beginning.

Let anything interfere with tissue resistance, and the organisms will increase in virulence, and to the same degree. Anything that increases tissue resistance reduces the number of organisms. Anything that keeps the tissues in a condition of chronic irritation reduces tissue resistance. We now know, and we must convince the patient, that diet in all of its aspects is intimately concerned with tissue resistance, the vitamins acting in a regulatory capacity and the other factors in a nutritional way. The endocrine glands, being regulatory mechanisms, must themselves be supplied with proper dietary nourishment to prevent hypofunctioning or hyperfunctioning of the glands. The gingivitis of pregnancy is irrefutable evidence of glandular upset or imbalance.

We know that brushing to remove food débris, regardless of the degree of efficiency, is the lesser part of oral hygiene, and that active massaging of the tissues to force into the lymphatics toxic waste products which have collected in the tissues and to force stagnant blood into the venous circulation is prerequisite to the entrance of fresh arterial blood, with its supply of oxygen, tissue building materials and hormones. Massaging, a mechanical force-pumping of blood and lymph by alternately pressing and releasing the tissues, has the major part in either maintaining or restoring healthy tissues.

The ulcerous character of some of these extreme gingivitis cases requires explanation. Many classes of agents are capable of causing ulceration. Dentists purposely produce ulceration in the therapeutic application of caustic drugs, in the employment of modalities and in surgery. Ulceration occurs physiologically whenever tissue surfaces are deprived of proper nourishment, either quantitatively or qualitatively. Ulceration occurs pathologically in the presence of toxic material elaborated either within or upon the surface of tissues. Within tissues, the toxic materials are elaborated when necrosis occurs as a result of loss of nourishment from any cause. If, in such an area, the diffusion of lymph is so slow as to fail to dilute the toxins rapidly and carry them to the lymphatics; or if the blood is unable to oxidize or otherwise detoxify these materials, not only are the tissue cells directly injured, but also their life lines, the blood and lymph channels, are damaged, if not destroyed. Not only is elimination of waste and toxic materials reduced to a minimum, but the defensive mechanisms are rendered inactive and repair and regeneration retarded.

The net result of these disturbances is

additional necrosis, involving the surface tissues, with subsequent additional sloughing and ulceration, all of which may be accomplished in the absence of specific infection.

Upon the surface of tissues, toxins are elaborated by bacteria in their life processes. These toxins are, of course, diluted by saliva and are removed mainly by swallowing, but, to some extent, they are absorbed by the tissues, where they produce conditions identical to those produced by tissue toxins—necrosis and ulceration. The organisms of Vincent's infection, whatever their structure, evidently produce an extremely active toxin. The more virulent the organisms, the more toxic are their products and, of course, the more acute are the symptoms.

These symptoms, both objective and subjective, are evidence of the status of resistance of the host and the oral tissues. The extent of damage to the tissues depends on (1) the degree of tissue resistance; (2) the degree of toxicity of bacterial waste products, and (3) the length of time required to reduce the virulence of the organisms, thereby reducing the toxicity. Extremely virulent organisms, in a mouth whose mucous membranes are already low in resistance, are capable of throwing off toxins that can denude the alveolar crest in from thirty-six to forty-eight hours and destroy from 1 to 3 mm. of this crest. This destruction is accomplished before the body defenses can overcome the bacteria to the extent of reducing their toxins sufficiently to stop the destruction.

The patient is genuinely sick. From a military standpoint, he is not only unfit for duty, but also requires hospital care, with all that that implies. When finally pronounced fit for duty, he is still a menace, in spite of his attempt not to infect any one. His infection will almost certainly become chronic. In civilian life, there is a much better chance of reducing the infection to impotency because of the possibility of maintaining sanitary and hygienic conditions.

The profession is not particularly worried about acute Vincent's infection so long as the cases can be treated early. The chronic cases are our great responsibility and, even with these, we have made considerable progress.

The following fundamental principles should be observed strictly. The same treatment and the same precautions, with increased emphasis on home care, are to be followed as in acute cases. There are a number of drugs employment of which, in conjunction with other fundamental procedures, will probably give satisfactory results. This fact alone relegates the specific drug to secondary importance. Of primary importance is thoroughness of application of the drug and home care.

The following steps are of paramount importance. First, in order for any drug to exert its action on vital tissues, the field must be cleared of débris, which acts as a barrier and prevents penetration of the specific into the vital tissues within hidden pockets. The viable and virulent organisms are located within these pockets. This débris, which consists of necrotic tissue, either loose or attached, and a viscid saliva and food particles, not only absorbs the major part of the specific, but also insulates the vital tissues and helps maintain anerobic conditions. This débris also causes additional irritation both mechanically and chemically. The field having been cleared, the drug, preferably a dye or stain, must be carried into the pockets and crevices and into contact with the vital tissues, with no part of the gingivae omitted. Thoroughness of application is the keynote.

The application, together with instruction on home care, constitutes the initial treatment. On the next two days, the procedure is to be repeated. Treatment on three successive days is based on the

bacteriologic technic for sterilization, in which the initial treatment disposes of adult organisms; the second treatment, at the end of the incubation period, disposes of adults recently developed from spores, and the third treatment, at the end of the succeeding incubation period, destroys any survivors.

During treatment, the patient should use a mouthwash to hold any ground gained by treatment at the chair. He must massage the gums by pressure, and brush carefully. A fourth or fifth treatment may be given at the discretion of the dentist, but usually three treatments suffice in cases of uncomplicated chronic Vincent's infection.

The assumption that chronic Vincent's is, in a large percentage of cases, complicated by the presence of other infection—evidence pointing to a fungus material—represents the most important step in our progress with these cases. Whether the assumption is correct or not, a treatment devised to eliminate irritation by fungus material at the start gives results almost as satisfactory as those obtained in acute cases. Presumably, acute cases are not so complicated, for the simple reason that other organisms cannot survive the highly toxic waste materials of virulent Vincent's organisms. This explanation constitutes at once a logical reason for the ease with which acute cases are cleared up and for the difficulty encountered with most of the chronic cases.

The latest step in our progress is characterized by a growing conviction that many cases diagnosed and treated as chronic Vincent's infection are, in all probability, a gingivitis of some other order, and that the beneficial results obtained in these cases are due more to the cooperation of the patient in home care than to the treatment.

A number of conditions combine to produce a gingivitis which simulates chronic Vincent's infection so closely as to defy differentiation, especially a gingivitis complicated with fungi. Interestingly enough, such cases yield both a spirochete and a fusiformis, but these organisms should be considered incidental to the environment rather than etiologic. Such conditions as avitaminosis, endocrine imbalance, hypostasis, blood dyscrasia, impairment of vasomotor regulation of end vessels and affections of the upper respiratory tract can conceivably disrupt tissue economy, thereby lowering the resistance of the oral tissues to infection and, in extreme cases, resulting in necrosis of the gingival crest and ulceration. Such disturbance unquestionably constitutes an injury and therefore may initiate inflammation of approximately the same degree as in chronic Vincent's infection, simulating that lesion so closely as to be misleading.

The above-enumerated physiopathologic conditions may be considered as the fifth columnists which, in very truth, tear down from within while bacteria and fungi, fermentation, alcoholic prescriptions, misfitting appliances and neglect of oral hygiene attack from without. Fortunately, most of the treatments devised for Vincent's infection are not injurious to normal tissue and, therefore, are not necessarily contraindicated in these extraordinary gingivitis cases. With the one exception of fungus complication, they are probably as efficient in these cases as anything forthcoming.

In conclusion, it may be said that the status of Vincent's infection today, at least in our locality, is nearly the same as that of a severe gingivitis of any other etiology. In our infirmary, in the last three years, there have been not more than a half-dozen cases of typical acute Vincent's infection. The so-called chronic cases have responded to routine treatment, but many of them have shown a variation which would seem to indicate a disturbance of other etiology. Apparently, our clinical material is the same in every respect as it has been for the past twenty-five years, and so it

would seem that either something has happened in the life history of Vincent's organisms to account for this state, or we have been ascribing to the lesions the wrong etiology. It could be the result of an educational campaign in oral health, or it could be that Vincent's infection is at the bottom of its graph of incidence by years. If it is merely at ebb tide, there is all the more reason for us to be on the alert, because the crest of this graph of incidence and the curve of sociomilitary activity are likely to intersect in the very near future. When this time comes, I hope to see intravenous injection relegated to the realm of adjuvant, because, as a primary treatment for Vincent's infection, it succeeds only in hastening acute cases to the chronic stage and delays proper treatment of chronic cases by weeks or months. If the evidence as presented in our infirmary is representative, we are quite justified in saying that physicians would render a much greater service in these cases by hurrying them to their dentist, who has both the armamentarium and the requisite technic for handling them.

The treatment for Vincent's infection and its complication as outlined below is in no sense revolutionary: on the contrary, it is purely evolutionary. Nearly all known remedies were tried, but the results produced by chromic acid, hydrogen peroxide and a dye or stain were most satisfactory. The first mistake in the use of these drugs was the assumption that any single one of them was adequate. The next mistake was failure to appreciate the necessity of reaching the virulent organisms buried in the vital tissues. A third mistake was disregard of the principle of sterilization as employed in a bacteriologic technic. We were not treating the condition at sufficiently close intervals, leaving the second appointment to the convenience of the patient in some instances, and often deliberately delaying the second appointment.

Combination of these three drugs, accidental though it was, worked like magic and crystallized the following procedure, which we now use routinely in all cases of gingivitis. First, the tissues are freed of necrotic and other material, the operator making doubly sure that the pockets are not overlooked. This is accomplished with 10 per cent chromic acid,[1] which is pumped into the pockets and crevices by means of a special applicator,[2] until these harbors are flooded. Then hydrogen-peroxide is sprayed very lightly over the chromic acid. The acid should instantly turn from yellow to jet black. This color reaction, together with the evolution of oxygen bubbles, which slowly changes the acid to gray, is indication of neutralization of the acid, which has already done its work. The reaction is allowed to go on to completion, as indicated by no further bubbling and no yellow remaining. We then use the spray with force and have the patient rinse the mouth with water to remove traces of the hydrogen peroxide, which would interfere with the desired action of the chromic acid next applied. We proceed as described until the gingivae are cleaned up.

The final step is the application of the specific dye or stain. It is essential that the dye reach the vital tissue within the

1. The action of chromic acid is threefold: to coagulate and loosen necrotic tissue; contact the agent or vehicle for liberating nascent oxygen against denuded vital tissue within the pockets, and to mordantize vital tissue, making it deeply receptive of mercurochrome. Ten per cent chromic acid etches enamel within ten minutes, but this action is stopped by chemical union with hydrogen peroxide. This time limit requires division of the arches into three areas each for application. Capillarity within pockets insures acid at the bottom if acid is used in excess and pumped in with small applicators. It does not injure vital tissue and has some germicidal action.

2. A No. 4 barbed canal broach with point clipped and barbs dulled by a stone. The corrugations are wrapped with a small amount of cotton and the shank bent to a 45-degree angle. Cotton serves to carry the drug and to remove débris.

pocket as only in this way, seemingly, can the virulent spirochetes buried within the vital tissues be reached. We use for this purpose a 10 per cent aqueous solution of mercurochrome. Medical practitioners disparage the use of this drug, but its use in this way gives desired results.

This completes the first treatment at the chair. We supply the patient with an oxidizing mouthwash[3] to which is added copper sulfate in sufficient quantity to make a 0.1 per cent solution. The oxidizing mouthwash maintains the status quo, while the copper sulfate reduces fungus activity. In most cases, this quantity of copper sulfate is able to either eliminate fungi or render them incapable of causing irritation. If, in this strength, it is unable to dispose of the fungus, as evidenced by failure of the case to respond to treatment beyond a certain degree, the patient is subjected to a copper sulfate pack treatment[4] in conjunction with the routine treatment.

Our experience has been that addition of copper sulfate in 0.1 per cent strength to the mouthwash reduces suspected fungi in about 95 per cent of the cases. Rarely is it necessary to employ the pack method of treatment a second time. The second and third treatments at the chair are repetitions of the first and they are given on successive days. This is mandatory. Under no circumstances should there be any scaling or other traumatizing of the tissues until the symptom of soreness has disappeared. We interpret soreness as evidence of toxic irritation, which, in turn, is evidence of survival of more or less virulent infection, apt to spread from instrumentation.

When the soreness has disappeared, scaling and polishing are not only in order, but also absolutely necessary. Calculus under the gum is analogous to a cinder in the eye and although less painful is nevertheless irritating. Chronic irritation due to the presence of residual calculus alone or together with systemic deficiencies prevents the tissues from making that last and final effort necessary to complete recovery.

During the first treatment and while the patient is properly conditioned mentally, we instruct him on the methods of spreading the condition, prevention of recurrence and home care. We get more cooperation and better results by emphasizing the fact that brushing and massaging are two separate and distinct operations.

Patients get better results when they manipulate the brush, not with the idea of sweeping the teeth, but of picking them. When they think of the brush

3. Formula:

Fowler's solution,	6 fluid ounces
Glycerine,	4 fluid ounces
Hydrogen peroxide,	½ gallon
Dist. water q.s.a.d.	1 gallon

It is compatible with copper sulfate. Anhydrous copper sulfate is obtained by heating the crystals until white and powdery. It may be put up in No. 4 capsuls, and one capsul added to 8 ounces of the wash just before dispensing. This is an approximately correct amount to make 0.1 per cent solution.

4. Powdered copper sulfate is carried on moist cotton pledgets of suitable size and packed into the interproximal spaces and pockets, where it is left three minutes. Materials: One dozen small cotton pledgets assorted size; small dish of saturated aqueous solution of copper sulfate; small dish of powdered copper sulfate; saliva ejector; cotton rolls; warm air syringe; mirror; explorer, and plyers. Technic: With the patient upright and saliva ejector functioning, instruct the patient not to swallow. Isolate the molar-bicuspid area with rolls and dry the gingivae, crowns and interproximal spaces with warm air. Immerse a pellet in the saturated solution, touch it to the powdered sulfate and carry it to spaces with plyers. Roll it into position with an explorer. While the pockets are being subjected to the action of the sulfate, swab the gingivae and crowns with a large ball of cotton soaked in the saturated solution. After three minutes, remove and count the pellets, rinse the mouth and have the patient expectorate. The entire gingiva must be treated. Follow procedure immediately with regular Vincent's treatment.

as a sort of compound toothpick or a collection of minute toothpicks to be inserted between the teeth as the wooden toothpick is used, they are more likely to use it that way. They soon learn from the feeling in the gums how to produce the desired gouging action, employing a short back and forth motion. The picking and gouging by the ends of the bristles has a much better chance of dislodging mucous plaques than does the mere sweeping action of the brushing stroke.

Extra-oral massage, in addition to being quite as efficient as direct massage, is much more likely to be carried out because preliminary washing of the hands to avoid infection, as when massaging directly, is unnecessary. Intermittent pressure on the cheek and lips directly over the gums can be exerted dozens of times a day without interrupting other activities and, for this reason, is self-recommending.

Our final instruction to the patient is a warning that there must be no let-up in this program of brushing, massaging and general health building; that, in spite of their best efforts, should they become ill or even generally debilitated, they are likely to have a recurrence, and, in any case, they should seek a dentist for a series of treatments.

TREATMENT OF PERIODONTAL DISEASE: PREVENTIVE PHASE

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TREATMENT of periodontal disease as of other diseases is most direct in its action and satisfactory in its results if founded on an understanding of etiology. The term periodontal disease is here used to cover a group of disease processes which either severally or collectively attack the supporting tissues of the tooth in such a way as to undermine their integrity, with exfoliation of the tooth as the end-result. Periodontal disease is unique with regard to its effect on the periodontium. This fact may be made explicit by calling attention to the fact that, while inflammation is experienced both in the course of periodontal disease and in periapical infection, the latter does not result in progressive destruction of tooth support and hence does not lead to spontaneous loss of the tooth. It is not sufficient, then, to say that periodontal disease is an inflammation of the periodontal tissues, although inflammation is a cardinal feature of advanced, and often of early, periodontal disease.

In seeking the etiology of this condition, it is desirable to omit consideration of inflammation as such and focus attention on the degenerative processes that precede and also make possible the invasion of micro-organisms and the resulting inflammatory changes. Consider that for periodontal disease to become established and reach even a moderately advanced stage, three dissimilar tissues

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must be attacked and measurably damaged, the gingiva, the pericementum and the alveolar bone immediately around the tooth. Of these, the pericementum or periodontal membrane and the alveolar bone are less obviously open to attack, being offered a degree of protection from injurious oral influences by the overlying gingiva. Yet, while the gingiva is commonly the first of these tissues to become diseased, with subsequent extension of such disease to the deeper structures, it frequently happens that a less obvious but none the less potent attack on the alveolopericemental mechanism constitutes the first phase of the periodontal disease syndrome, with involvement of the gingiva as a secondary pathosis. Combinations of these two basic types of disease are possible.

Since the etiology of periodontoclasia is complex, it might be inferred that preventive and curative treatment will be equally complex. While the former statement is true, it does not follow that the latter is equally accurate, at least as far as fundamental principles are concerned.

The cause of periodontal disease combines certain local elements the nature and action of which are well known and certain systemic elements some of which are obscure as to their basis. Local and systemic causes vary in their proportionate potency in individual cases, but, in the majority of cases, local conditions seem to exert the dominant influence. Of the local factors, irritants acting on the gingival margin, such as calculus and other impinging foreign matter, and injurious agents, such as traumatogenic occlusion acting on the periodontal membrane, claim chief attention.

In the group of local factors, calculus is commonly regarded as the most important. As a gingival irritant, it easily assumes first place. Verification of this statement is provided in neglected mouths, where the constantly growing accretion is the central causative factor in the process of gingival inflammation and recession and of the wasting of the pericementum and alveolar bone. While the calcific deposit is usually looked on as a purely local factor, there is to be considered the question as to what causes this deposition. In some mouths, calculus deposition is heavy; in others, scanty. It seldom occurs in children under 10. These variations, whether based on diet, including mineral intake, or on individual idiosyncrasy, are essentially systemic in their background.

More truly and exclusively local is food impaction, irritation from crown bands, damage to the gingivae from improper toothbrushing, etc. These factors, together with that of calculus deposition, tend to cause a type of periodontoclasia called by Box periodontitis simplex.

A local condition capable of causing severe damage is traumatic occlusion, more properly termed by Box traumatogenic occlusion. This condition, which comprises essentially a maldistribution or an excessive amount of stress when the teeth are brought into occlusal contact, is local in its origin and application, but depends to a degree, as to periodontal damage produced, on some systemic condition not as yet understood.

In other words, occlusal disharmony expressed as traumatogenic occlusion in certain cases causes alveolar resorption and pericemental degeneration and tends to lead to suppurative disease of the entire periodontal unit. This is periodontitis complex (Box). In other cases, however, the same occlusal disharmony causes no deep periodontal damage, but does cause injuries of other types. It must be mentioned too that, even in the former type of case, there is considerable variation as to the time of life when periodontal damage becomes manifest, regardless of the type or severity of the traumatogenic factor.

Variations in the behavior of alveolar bone must be accounted for on the basis of varying strength or physical-chemical

resistance in the alveolar bone, and it is in the direction of determining the secrets of this alveolar resistance that future periodontal research should be directed. The best explanation that can be offered at the moment is that there may be a continuing qualitative deficiency in the alveolar bone from infancy on and that this is probably related to rickets in the first year of life. The vitamin and calcium deficiency may not be severe enough to present obvious manifestations after the subsidence of the active phase of rickets, but may, if long continued, prevent the development of the type of alveolar resistance needed to withstand onerous occlusal stresses. Other factors may of course enter into this problem of below-par alveolar bone; e.g., hereditary tendencies.

Whatever the conditions that determine whether alveolar bone will break down, there is always to be reckoned with in this type of case the element of an occlusion presenting some departure from the physiologic, and this element must always receive our thoughtful attention when found. And it is found so often that the search for it must constitute an integral part of the examination of the mouth, whether or not there are observable indications that the periodontal tissues are below par.

Since this paper deals with the preventive phase of periodontal treatment, attention is directed to the period when the first symptoms of periodontal disorder appear and also to the first appearance of those conditions that bring on or tend to bring on periodontal disturbances. The two things are not always synchronous, for the foundations of disease may be laid in one period of life while the disease itself may not develop until many years later. At the same time, not only mild, but even severe periodontal disease may manifest itself in childhood or even in infancy.

Probably the first type of periodontal disturbance that may be observed is the inflammation of the gingivae associated with difficult teething. Reference is here made not merely to the tenderness and redness of the tissue over the erupting tooth, but also to the gingivitis, which may persist for some time after eruption. This is usually relieved by stepping up the vitamin-C intake. Since it is seldom seen in infants receiving an adequate amount of vitamin C, this element may be considered a preventive for this condition, as it is undoubtedly to a marked extent for gingivitis in the older child and adult.

Periodontal disturbances in infants are not all so simple as that just cited. Ulcerative stomatitis occurring in infants who are generally malnourished or below par may involve the gingivae and even the deeper periodontal structures. In acrodynia, which is fortunately rare, the investing structures of the teeth are severely affected and the teeth become loose and are easily dislodged. No specific preventive of these conditions is known, but measures which promote general good health, including adequate intake of the several vitamins, probably will give protection.

In the preschool and school child, gingivitis is quite common. This may be the result of vitamin-C deficiency of a minor degree which, because it is not severe, produces no recognizable symptoms in other parts of the body. Proof of the relationship is established if the gingivitis clears up when adequate amounts of tomatoes, oranges, etc., are added to the diet. This type of gingivitis is distributed rather uniformly through the mouth, and its generalized character is an important element in establishing the diagnosis. Even among the poor, gingivitis due to this condition is not ordinarily severe; hence, its true nature may readily be overlooked.

Generalized gingivitis may however be caused by other conditions. Lack of vigorous use of the teeth in mastication because of dependence on soft foods and

also diets rich in starchy foods, especially if taken at the end of a meal, lead to generalized gingivitis. The former is the direct antecedent of a sluggish gingival and periodontal circulation, with consequent lowered resistance to bacteria. Starchy foods tend to leave residue in the mouth in which various bacteria thrive. Retention of such decomposing material in contact with the gingivae tends to break down resistance. Careful inspection of the mouth will disclose this coating, which is not always conspicuous.

There may, of course, be a combination of the two conditions just mentioned, and often, in addition, a vitamin-C deficiency. No one of these conditions can safely be overlooked. Prevention is readily accomplished, as far as the mild scorbutic condition is concerned, by dietary correction. The same is true of the type due to food débris. Mastication may be inadequate because the child selects soft foods, the reason for this being the presence of cavities that cause pain if mastication is vigorous. The change frequently observed in the complexion of the mouth after all cavities have been filled is striking. For prevention of this type of gingivitis, the prescription is obvious: Fill all cavities as soon as discovered. This remedy is not easily applied if the cavities appear before the child is 2 years of age, as sometimes happens. From 2 years on, however, there is no great difficulty unless the child is abnormal.

Mention has been made of traumatogenic occlusion as an important local factor in periodontoclasia. This relationship has received much attention as regards the adult. But the presence of traumatogenic occlusion in the young individual is seldom commented on, nor is it usually appreciated that the disturbed occlusal relationships that may be noted in the young can cause appreciable periodontal damage in that period. At the Guggenheim Dental Clinic, recession of the gingival margin and alveolar resorption with attendant mobility, and with traumatogenic occlusion in evidence, are often observed in children under 12 years of age. Pocket formation with perceptible exudation of pus is rare at that time of life, but has been observed. More common is a thickening of the pericementum, observable in the roentgenogram. This may appear without other evidence of periodontal disturbance. It is most commonly associated with altered occlusal relations brought about by drifting of teeth after the extraction of a first permanent molar. This condition is apparently a forerunner of or perhaps is the first stage of periodontitis complex.

Treatment of cases of periodontal disease in the young patient whose condition is traceable to traumatogenic occlusion is often difficult if the occlusal disharmony is severe, and particularly if the arch has been mutilated by extractions. Premature loss of deciduous molars may throw excessive stress on the remaining teeth and excessive overbite of the anterior teeth will usually develop. This leads to a thickening and usually to a redness of the gingival margins in the anterior region. Since this condition is not due to deposition of calculus or other foreign material, prophylactic treatment brings little if any improvement. Stimulation of the gingivae by means of the toothbrush or by other massage will usually keep the inflammatory condition under control until there are enough permanent teeth in the mouth to make orthodontic treatment feasible.

Relief of traumatogenic occlusion in the young patient is difficult to achieve even when all teeth are present. There is no worth while curve of Spee to be found before the eruption of the second molars, and it does not attain its full development until the third molars erupt. Excessive overbite of the anterior teeth is common. Consequently, balancing of the occlusion, especially for protrusive excursions, is only partially attainable.

Thought naturally turns in this event to orthodontic treatment, and this is frequently the only real remedy available. Excessive overbite of the anterior teeth, and the narrowing of the arch that is usually associated with it, can and should be corrected by such treatment whenever found, regardless of whether relations are otherwise satisfactory.

Mention was made of premature loss of deciduous molars as a cause of traumatogenic occlusion through shifting of stress to the remaining teeth, with consequent overloading. This unfortunate event may in addition have repercussions that will be heard many years later. This is because of malocclusion that may follow, brought about by drifting both of the permanent molars and of the anterior segment of the arch. Crowding and displacement of premolars are important features of this malocclusion, but malrelationship of the first permanent molars is a common sequel, as well.

Loss of first permanent molars, without replacement, has deservedly had much attention in periodontal literature, because of its causative relationship to periodontoclasia. Countless arches which otherwise would have presented an occlusion well within physiologic bounds have suffered degradation through unrestored loss of first permanent molars. This loss is apt to occur in childhood and is seldom followed quickly by periodontal disease. Hence, in these cases, even the dentist may be lulled into an ill-founded feeling of security. Symptoms of disease may not show themselves until many years later, and by the time they appear, the malposition of the premolars, and especially of the second molars, may be so gross that only through orthodontic treatment can a condition be brought about that will make remedial treatment feasible and effective. Incidentally, it is not always realized, but it is a fact, that orthodontic treatment may safely and satisfactorily be applied in adult cases.

It is evident from the foregoing that the preventive phase of the treatment of periodontoclasia in the adult properly begins with the management of the dentition in childhood, and that the care of the child's mouth is to be approached with a full appreciation of the far-reaching consequences of what is or is not done.

Another item that enters importantly into the preventive treatment of periodontal disease is vigorous mastication. The value of exercise thus brought about has often been stressed, but with too little attention to the time of life when such exercise should be taken. This should be in childhood and for two equally good reasons; first, the part played by exercise in the growth and development of the jaw. Vigorous chewing of suitable foods encourages the development of broad arches, minimizing the tendency to crowding and excessive overbite of the anterior teeth and favoring normal interdigitation of the cusps of the posterior teeth. At the same time, exercise develops a strong jaw structure and resistant periodontal tissues.

The second reason why vigorous mastication should be encouraged in childhood is that, at this period, the natural milling in or balancing of occlusion by natural attrition can be brought about with the least likelihood of its causing deep-seated damage, always provided there are no severe incoordinations of the occluding surfaces present. In this connection, attention should be called to the advantages of the use of an abrasive chewing gum, at the direction or under the careful observation of the dentist, to secure good occlusal balance. It may be stated parenthetically that incoordination of some degree is to be expected in every dentition since no dentition has been found, according to leading orthodontists, to exhibit an ideal occlusion. Therefore, unless balancing of the occlusion is attained by natural or artificial means (and even when orthodontic treatment is

given, some milling in will still be required), the average adult mouth will present some traumatogenic occlusion and probably will have experienced some periodontal damage. To require the possessor of such a dentition to inaugurate a régime of vigorous mastication, either with or without occlusal equilibration, is to risk further breaking down of alveolar bone.

For the adult, it is better to let nature decide how much exercise should be taken. This, of course, does not mean that eating of detergent foods should be omitted. The eating of food with a scouring action is valuable for maintaining normal cleanliness and for its massage effect on the gingival margins, but voluntarily induced heavy exercise started at or near middle life may cause harm.

Another item in the preventive program that ranks in value with any of those mentioned is gingival stimulation, which is accomplished acceptably by the toothbrush when properly used. There are several good technics. For the mouth in which the interdental papillae occupy the normal position, the brush should not be used in any way that will cause pricking of this part of the gingival tissue. Observation of mouths in which vigorous use of the brush from early years has been the rule indicates clearly that tremendous resistance to infection can by that means be built up in the gingivae.

Treatment of incipient periodontoclasia, which may well be included in the program for the preventive phase of the subject, requires careful consideration of all the foregoing items since any or all of them may be involved in the treatment of what may appear to be a simple gingivitis. In addition, there will practically always, except possibly in the young child, be a need for careful scaling of the teeth, both supragingivally and subgingivally. This operation, which should be one of the simplest and most fundamental services performed for a patient, and which is regarded by many dentists as constituting the be-all and end-all of periodontic treatment, is nevertheless often carried out with little skill and no check-up as to its completeness. Particularly should skill be developed in scaling beneath the gum margin since this is nearly always needed in periodontal treatment, and, in the incipient or early case, the pockets will be shallow. In such cases, there can be no justification for so-called surgical or electrocoagulation treatment even if one of these methods is considered desirable for the treatment of advanced lesions.

In conclusion, it should be stated that prevention is the best cure, and that this begins indirectly but clearly in the prenatal period with development of sound, resistant tooth structure, and continues through infancy and childhood, again with attention equally to the integrity of the teeth themselves and to the fundamental health of the periodontal tissues. An adequate and well-balanced diet, vigorous mastication, effective gingival stimulation, proper dental care and skilful prophylactic treatment, given when indicated according to individual needs, round out the program.

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THE DEVELOPMENT OF THE NATIONAL BOARD OF DENTAL EXAMINERS

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IT probably is fair to assume that the manner in which dental examining boards in the various states came into being is unknown to the majority of practitioners today. A brief and undoubtedly correct history is found in Bulletin Number Nineteen of the Carnegie Foundation for the Advancement of Teaching, under the title "Dental Education in the United States and Canada." It states:

Before 1868 there were no special educational prerequisites to the study of dentistry and practically no legal restrictions of its practice. During the thirty years from 1840 to 1870, the number of active dental schools in the United States slowly increased to ten, but the total number of their graduates during the whole of that period was only 1,305; and in 1870 the proportion of graduates in the total number of practitioners was certainly less than 15 per cent. Many of the dentists of this period were notoriously incompetent and irresponsible, and their superficiality and commercialism evoked earnest protests from their self-respecting colleagues. The earliest dental societies formally recorded the desire and purpose of their founders to "elevate the profession from the degraded condition to which it had sunk," and the objects of the American Society of Dental Surgeons, as stated in its constitution, included the aim "to give character and respectability to the profession, by establishing a line of distinction between the truly meritorious and skillful, and such a riot in the ill gotten fruit of unblushing impudence and empiricism."

For nearly three decades after the establishment of the first dental school, the efforts of the better trained and more earnest dentists to prevent continual increase in the number of unworthy and unscrupulous practitioners were comparatively unsuccessful. By 1867, the year in which the Harvard Dental School was established, conditions had grown serious enough to demonstrate that relief from an intolerable situation could not be obtained without recourse to state control.

Shortly after the opening of the first dental school's second year, in Baltimore, Alabama enacted a law which nominally restricted dental practitioners in that state to those who were formally adjudged by medical examiners to be qualified, but the law was indifferently enforced. For nearly three decades, nothing more was accomplished to control the practice of dentistry. In 1868, Kentucky, New York and Ohio, under the guidance of progressive dentists, enacted statutes that put the practice of dentistry within their respective boundaries under public defensive regulation.

The original Alabama statute, which was adopted in December 1841 and became operative a year later, provided that applicants for admission to the practice of dentistry should be examined and licensed by the "medical board of the state," under the general restrictions that applied to admission to the practice of medicine; but no educational qualifications were specified. Enforcement of these provisions seems to have been neglected from the beginning, and, during the progress of the Civil War and until 1881, when a new statute was substituted, this original dental act was practically inoperative.

The original dental law of the State of Kentucky was enacted by the legislature in February 1868, in response to a petition from a number of resident dentists, who declared that dentistry was "a specialty of the healing art"; that "at least two years of close application to study with competent instructors" was necessary for the acquisition of adequate knowledge and proficiency, and that "the people of this Commonwealth are being grossly imposed upon by the merest pretenders to dental science, without possessing a knowledge of the first principles requisite to its successful practice; hence much suffering, discomfort, and ill health, results that might and should be averted." The first Kentucky statute incorporated the Kentucky State Dental Association and authorized the association to appoint a board of dental examiners having power to license graduates of dental schools without examination, and also others found by examination to be competent. This plan followed that long in vogue for the control of medical practice.

The original New York statute, adopted in April 1868, established the Dental Society of the State of New York, and gave it the duty of maintaining a board of censors. This board, as the agent of the society, was empowered to examine applicants who received diplomas from dental schools in the State of New York, and also any "student who shall have studied and practised dental surgery with some accredited dentist or dentists for the term of four years," or for a shorter period under various specified circumstances, including an allowance of one year for "attendance at a complete course of lectures of any incorporated dental or medical college in this state or elsewhere." The society's diploma or certificate of license was awarded to all who passed the examinations, in accordance with the analogous procedure for physicians adopted several decades earlier.

The Ohio statute, resulting from the activity of the state dental society and approved in May 1868, made it unlawful for any person to practice dentistry in that state who had not received a diploma from a dental school, or who had not received a certificate of qualification from the Board of Examiners of the Ohio State Dental Society or from an associated local society; but physicians and surgeons were specifically authorized to extract teeth.

Most of the earlier dental acts empowered state boards to issue licenses, without examination, to applicant graduates of dental schools, but all of the statutes required the boards to determine, by examination, the competency of any person who desired to begin practice after the enactment of the corresponding state law, but had not graduated from a dental school. Cumulatively effective enforcement of the dental laws, after their adoption successively in all of the states by 1899, gradually led prospective dentists to understand that the safest as well as the best route into dental practice was through a school of dentistry, and the preceptorial method of training general practitioners consequently fell into disuse, although it survives for specialists.

From what has been recited, it is evident that the development of state laws throughout the country was one of slow progress, and the records show that not until 1907 did the statutes of every state contain provisions for boards of licensure in dentistry. The National Association of Dental Examiners, organized in 1882, was the body that led the way in this effort to protect the practitioner as well as the public. It was in its deliberations of 1902 that the resolution adopted at the meeting at Asheville, N. C., climaxed years of discussion on reciprocity among the states. The failure to attain reciprocity was attributable to the divergent standards of requirements in the various states.

In 1917, the president of the National Association of Dental Examiners, Alexandar H. Reynolds, of Philadelphia, made the suggestion that a central board of five members be created to conduct examinations for general reciprocity. In 1919, a motion from the floor of the national association for the consideration of a tentative plan was rejected.

Probably no better statement of the problem of reciprocity can be found than in the resolution of Harvey C. Newman, in his presidential address in Cleveland in 1923:

> Resolved that we consider Universal Reciprocity to be ideal, but that until such a time as the method of the selection of the personnel of State Boards and the method of conducting examinations are standardized in every state of the union, so-called Universal Reciprocity be not deemed practical.

That statement is just as applicable in 1941 as it was in 1923.

Nevertheless, the question has been continually discussed among dentists in and out of society meetings for more than two score years. In 1924, Alfred P. Lee, president of the National Association of Dental Examiners, appointed a committee on a "national board of dental examiners." This was brought about largely because of an inquiry from the Carnegie Foundation which intimated that it might give financial aid to such a movement, having done so to the National Board of Medical Examiners. At the same meeting of the National Association of Dental Examiners, William J. Gies, of New York, stated:

> It has been suggested that a national board of dental examiners be created to serve in an advisory relation to your association and to the state boards—to co-operate with, but in no sense to regulate or control the action of, state boards. The suggestion includes the idea that you create for dentistry a board that would be similar to the National Board of Medical Examiners, which, with the financial support of the Carnegie Corporation, has been serving medicine so satisfactorily that thirty-five state boards now voluntarily accept its examinations as the full equivalent of their own examinations in medicine. The results of the examinations conducted by the National Board of Medical Examiners are accepted in these states as if they came from a state board on a reciprocity agreement, but each state board is free morally and legally to reject all or any such certificates; and is not obliged by implication or agreement, under any circumstances, to honor a single certificate issued by that national board. Each state board acts on its own judgment. . . . The freedom of a state board in this relation could not legally be impaired. No one would wish it to be. . . . A national board of dental examiners . . . would help to establish a sound basis for desirable interstate exchange of practitioners.

It was voted "that the president of the National Association of Dental Examiners appoint a committee to confer with like committees from the Association of Faculties and the American Dental Association to consider the matter of the National Dental Examining Board."

At the same meeting, J. A. Baldwin, of Louisville, Ky., in discussing the national board, stated:

> I don't think that the gentlemen need have any fear at all. If you will just remember that the granting of a license or the revoking of a license, especially, is a matter of the police power of the state, a sovereign right of the states, no board, no organization, nor the Federal government itself under ordinary circumstances can take from the individual states that right. In the last analysis, every man that passes, if this board is created, every man that takes this examination, is examined by the individual state in which he practices; he must be. Now how much examination you give him lies largely with the state board of that individual state. So I think there is no fear that they will be able to cram down the throats an undesirable man.

Dr. Gies also stated at this meeting:

> The boards are the ultimate arbiters; the courts won't take the right away because the law gives it to you. If you receive a certificate from your own national board of examiners, it is a piece of paper that you may decide to accept because you have faith

in it, or throw in the waste basket because you haven't.

In 1925, the question was discussed at great length by the National Association of Dental Examiners in Louisville, but was finally tabled for one year by a vote of 77½ to 72½. In the House of Delegates of the American Dental Association the same year, the general plan of a national board was approved without a dissenting vote.

In 1926, with the question again under discussion, Albert L. Midgley, of Providence, R. I., a member of the Rhode Island State Board, said:

The question for us to decide is whether the principle of a national board of dental examiners is for the best interests of the public and dentistry. The fact that the Carnegie Foundation for the Advancement of Teaching has suggested this desirable action should be sufficient evidence that it is sound, because the foundation is chiefly interested in the promotion of better health service through education. The fact also that there is a National Board of Medical Examiners ought to influence us. . . . Then, too, all the other organizations have accepted the plan in principle, so I sincerely trust that after studying the proposition, you men will be influenced by the importance of unified effort and unity of purpose, and will support one of the most useful measures for the improvement of dentistry that have been presented during the twenty-one years that I have been a member of this organization.

A vote by states resulted in the adoption of the report of the Committee of 1925—111¼ to 43¾. Upon motion by George B. Vann, the adoption was made unanimous. This action of Dr. Vann was indicative of the attitude of many of the men interested in the problem. He was reluctant to rush in, but was willing to give the proposal an opportunity to justify itself.

Editorially in November 1926, the *Dental Cosmos* wrote:

One of the most significant accomplishments of the group of meetings held in conjunction with the recent International Congress and one signifying in tangible form the spirit of fraternity which was quite apparently the keynote of that memorable gathering was the adoption of a resolution by the National Association of Dental Examiners affirming the establishment of a national examining board. A national examining board has long been desired by the profession as a whole, but has been unnecessarily and inexcusably delayed through the prejudicial shortsightedness of a few individuals. . . . We are confident that the consummation of this plan (a national board) will be approved and much applauded by the profession generally.

The next year found Henry L. Banzhaf, of Milwaukee, Wis., President of the American Dental Association, expounding the benefits of a national board to the House of Delegates of the Association:

The National Board of Dental Examiners will establish a logical basis for the suitable exchange of licenses between states; it will assist state board examiners in their efforts to give fair and reasonable examinations; it will assist dental schools by providing them with a more authoritative measure of the degree of knowledge possessed by their graduates.

In 1927, the National Association of Dental Examiners adopted the following resolution:

Inasmuch as we endorsed the creation of a National Board of Dental Examiners at our last session we reaffirm and give our hearty endorsement and offer our undivided support to the organization of such a body.

After the presidential report of Henry J. Feltus, of Baton Rouge, La., in 1928, much discussion took place in the Minneapolis meeting with the definite information at hand that the Carnegie Corporation could not assist in the matter of finance. William J. Gies expressed his embarrassment at the situation, but attributed it to the failure of the National Association of Dental Examiners to arrive at a decision in 1925. He also mentioned the fact that some problems arose after the Detroit meeting, as well

as the reported large amount of money in the American Dental Association treasury. These facts, he stated, made it appear that help from outside sources was not necessary.

Unfortunately, at this meeting in Minneapolis, there was some difficulty because of nominations to the National Board by the immediate past president as well as the presiding officer of that year. This was eventually satisfactorily adjusted, and the importance of the National Board is evidenced again during this year in the report of the American Dental Association President, Roscoe H. Volland, of Iowa City, Iowa.

Prior to and since the Louisville meeting, a national examining board has been a prominent topic for discussion by the general membership and particularly by various interested groups. Many plans have been discussed for the organization, functioning and financing of such a board. During the last session of the Association, an amendment to the Constitution was offered which, if adopted, will authorize the appointment of five members to represent this Association on a national examining board. . . . The creation and the sane functioning of a national examining board, through its control and influence on standards and requirements for dental practice, should have a tendency to advance dentistry in all its phases and, therefore, the creation and fostering of a national board of dental examiners by this Association would be entirely in line with this Association's aims, purposes and ideals.

At this meeting of the American Dental Association, it was voted to adopt an amendment to the Administrative By-Laws, creating the National Board.

The following year, the Board, made up of representatives of the American Dental Association, the National Association of Dental Examiners and American Association of Dental Faculties met in Chicago, in January, and adopted by-laws, rules and regulations. The board was organized as follows: chairman, John V. Conzett, Dubuque, Iowa; secretary, Alexander H. Reynolds, Philadelphia, Pa.; executive committee: William H. G. Logan, Chicago, Ill., Charles R. Turner, Philadelphia, Pa., and Morton J. Loeb, New Haven, Conn.; with other members as follows: L. Pierce Anthony, Philadelphia, Pa.; A. C. Wherry, Salt Lake City, Utah; Harry W. Nelson, Minneapolis, Minn.; J. Franklyn Cook, Los Angeles, Calif.; O. E. Jackson, San Francisco, Calif.; George E. Haigh, Jefferson City, Mo.; A. R. McDowell, San Francisco, Calif.; DeLos L. Hill, Atlanta, Ga., and H. L. Wheeler, New York, N Y.

The *Dental Cosmos*, February 1929, again commented on the National Board. This time it said, in part:

The formal creation of the National Board is an act which we believe will meet with general approval of the profession throughout the land. . . . The object and aims of the National Board of Dental Examiners will be to offer a standardized examination. . . . Participation by the various state boards is purely voluntary and the inherent rights of the individual state boards will in no way be infringed.

In Washington, in 1929, John V. Conzett, chairman of the National Board, reported to the National Association of Dental Examiners as follows:

The National Board of Dental Examiners is sponsored (by the American Dental Association) in this respect in that it pays the bills and we are mighty glad to have some one who will take the financial responsibility of this organization because we can't function unless we have money to work with and there is no other organization that can provide the means whereby we may attain our ends; therefore, it is with a great deal of pleasure that we received the sponsorship of the American Dental Association when last year at Minneapolis in connection with your organization and the Faculties Association there was created the National Board of Dental Examiners and they agreed to pay the expenses of that board, and from time to time we are placing our budget in the hands of the American Dental Association and they are footing the bills.

We have had several meetings which were rather expensive and the expenses of those meetings were paid from the treasury of the American Dental Association.

At the same meeting, Mr. Everett S. Elwood, of Philadelphia, executive-secretary of the National Board of Medical Examiners, told of the activities of that board and its success. The following resolution was adopted unanimously after a discussion concerning the method of representation:

The National Association of Dental Examiners will ratify the present plan of organization of the National Examining Board, provided: 1. The three parent bodies, the American Dental Association, the National Association of Dental Examiners and the Association of American Dental Schools, have equal representation thereon; and:

2. The appointive power shall be left solely to the parent organizations in naming their representatives.

A committee conveyed these sentiments to the House of Delegates of the American Dental Association, which voted that the resolution of the Board of Trustees of the American Dental Association changing the manner of selection of representatives for the National Association of Dental Examiners and American Association of Dental Schools be tabled and the original method of selection—each body naming its own—prevail.

George E. Burket, of Kingman, Kan., president of the National Association of Dental Examiners in 1928-1929, proposed a new plan of reciprocity in July 1930 at Denver, Colo. The plan, entirely replacing the original plan, provided that 10,000 dentists pay $55 each for a certificate, this $550,000 to provide the endowment under which the National Board would operate. As the discussion of this plan was in an "executive session," the reporter was instructed to omit it from the record. Very little reference to the Burket plan appears in the records, and it probably was not considered too seriously.

In Memphis, in 1931, there was no discussion of the National Board because it had not functioned and the American Dental Association had not allotted any funds to it in any appreciable amount owing to a falling off in receipts.

In Buffalo, in 1932, it was decided by the Board that it should inaugurate its examinations, and the following May 1933, the first session took place, in four cities: Chicago, Pittsburgh, Iowa City and Minneapolis. Eighty-one candidates participated. In the report as the President of the American Dental Association, G. Walter Dittmar again emphasized the position of the Board:

The rules governing the examination and the precautions observed to deal fairly and justly with each individual taking the test deeply impressed me and inspired my utmost confidence. Commendation is due the members of the National Board. . . . It is understood that the National Board of Dental Examiners can act only in an advisory capacity. It can have no legal standing, because each state is sovereign in the control of its licensing regulations; however, it can and surely will have a great influence on state examining boards, most of which will eventually give it recognition.

It was at the meeting of the National Association of Dental Examiners in Chicago in 1933 that Hugh S. Cummings, Surgeon General of the United States Public Health Service, said:

I want to relieve your mind of any apprehension, having just come from the National Board of Dental Examiners, that is, I can assure you there is no desire upon the part of this Board to relieve you of any obligations or duties or take the place of the state boards. We change the Constitution pretty fast and wide nowadays, but the police power of the states, in which is included the public health service, will always remain right with the state, I think.

At the same time, W. A. McCready, of Pittsburgh, Pa., reporting for the Committee to Promote Uniform Examinations in the National Association of Dental Examiners, concluded by saying:

It is very gratifying to us to know that the National Board of Dental Examiners has started to function. The methods of the National Board should be of the greatest aid in standardizing State Examinations.

Harry W. Nelson, secretary of the National Board since 1930, spoke at length to the National Association of Dental Examiners, explaining the method of conducting the examinations and its purposes. Notwithstanding a very clear exposition, many of his remarks were distorted and the implications were to the effect that there were some ulterior motives behind the Board. Many of those discussing the project showed lack of information in the matter. This may have been due to non-attendance at the earlier meetings in which the National Board was organized. At any rate, at the same meeting, in Chicago, in 1933, in a proposed revision of the National Association of Dental Examiners Constitution, provision was made for appointing its members to the National Board, and this recommendation was adopted at the session the next year.

In St. Paul, in 1934, Robert L. Sprau, of Louisville, Ky., in his presidential report to the National Association of Dental Examiners, included the following:

There has been formed, and it is beginning to fulfill part of its function, an organization whose father is the N.A.D.E. Several years ago, the N.A.D.E. conceived the idea of a national board of dental examiners. In the heated pros and cons, the American Dental Association adopted the child and from all appearances it is doing well. President Wherry, in his address to the House of Delegates of the A. D. A., will say: "It has been a source of great satisfaction to your President to observe the successful development of the National Board of Dental Examiners." Similar to the Educational Council, we are permitted by representation to sit in on the affairs of the body. The National Board rightfully belongs within the N.A.D.E. This statement is not made to invite discussion and it is seriously hoped that this question will not come up for debate as it is now so much water over the dam.

For years, the N.A.D.E. has discussed uniform examinations, reciprocity and model dental laws and no definite conclusions have been reached. Is not the National Board the answer to these questions? Dr. Conzett, president of the National Board, in his 1933 report to the House of Delegates of the A.D.A., closes with this statement: "We hold out the liveliest interest in a dental board that will solve the problem of actual reciprocity, in that a certificate of the National Board of Dental Examiners will be accepted in all the states of the union, thus doing away with the clumsy and inefficient manner in which a professional man is only permitted to practice in one state, no matter what his qualifications may be. By way of passing, it may be remarked that dental educational institutions have not yet reached a point of perfection whereby all of their graduates are of professional quality. . . .

Dr. Sprau's attitude was further emphasized by his recommendation:

That the Standing Committee on Uniform Examinations be abolished and the representatives on the National Board of Dental Examiners take over the duties of this committee and that the oldest member be designated as the chairman.

At this meeting of the National Association of Dental Examiners, much discussion again occurred concerning withdrawing from participation, in which leading members of the association took part. W. Ira Williams, Chicago, Ill.; George B. Vann, Gadston, Ala.; J. B. Carr, Indianapolis, Ind., and W. H. Robinson, San Francisco, Calif., all voiced approval of the plan and advocated giving the National Board a trial. Notwithstanding arguments against the Board, C. Willard Camalier, Washington, D. C., was appointed to fill an unexpired term on the Board.

All the proceedings concerning withdrawal were very interesting in view of the fact that no valid reason was advanced for withdrawing from a body that the National Association of Dental Examiners had helped to organize.

In the American Dental Association Presidential Report of 1934, Arthur T. Wherry referred to the National Board as follows:

It has been a source of great satisfaction to your President to observe the successful development of the National Board of Dental Examiners.

While they have been very careful in their work, deliberate in their policy of expanding activities and economical in their expenditures of funds—this board has gone forward safely and soundly in developing a nation-wide activity for our protection.

I bespeak for the Board of Dental Examiners your hearty approval and generous support, and I feel confident in making the prediction that, before many years, the membership of our profession will come to appreciate the developments of this board's program as one of the great achievements of our generation.

I commend the National Board of Dental Examiners for their progressive policies and forward-looking program.

At this meeting, the reference committee of the American Dental Association on Dental Legislation, of which W. H. Robinson, Oakland, Calif., was chairman, reported that "the report of the National Board of Dental Examiners being explanatory and carrying no recommendations, we wish to highly commend them for their diligence and suggest that their activity be continued."

In New Orleans, in 1935, a resolution of withdrawal was passed in the National Association of Dental Examiners notwithstanding the fact that the majority of the Committee to Investigate the National Board had reported favorably. A very comprehensive and favorable report was presented by the majority of the committee, E. W. Patton, of Birmingham, Ala., and W. Ira Williams, of Chicago, Ill. This report was compiled in part from questionnaires sent to the secretaries of both the National Board of Dental Examiners and the National Board of Medical Examiners and is such an excellent recital of facts that parts are quoted therefrom. An important statement is one taken from the remarks of Mr. Everett S. Elwood, secretary of the medical board, concerning the legal status of the National Board of Dental Examiners:

Another objection which was frequently raised by the state boards in the earlier days was that the National (Medical) Board had no legal status. When the National Board was first organized, it was thought by some that it would be advisable to secure a Federal charter by act of Congress. The matter was taken up informally with Mr. Elihu Root, who advised the founder of the National Medical Board that such a charter would be unnecessary. He stated that the National Board could never have licensing power without an amendment to the Federal Constitution; that inasmuch as it was a qualifying body solely, and always would be, it did not need to have a Federal charter. He further stated that, in his judgment, the procedure whereby a state board issues a license to practice medicine upon the basis of the National Board's examinations would be entirely legal if the medical practice act of the state in question was so worded that the board had the discretionary authority to accept the National Board's examinations in lieu of their own examination.

Further, the Committee to Investigate the National Board stated:

The records clearly show that the National Board of Dental Examiners was not foisted upon organized dentistry by any "clap-trap" or undercover methods for the purpose of exploitation; nor fostered by any group for ulterior motives. It rather appears to have been the outgrowth of an urgent need for a centralized agency of dental licensure, made necessary by virtue of the increasing complexity of professional relationships. While the National Association of Dental Examiners has furnished by election its quota of representatives on the National Board, the records fail to reveal that the former has ever taken formal action of endorsement. We are fully aware of the fact that the National Board is not a creature of the National Association of Dental Examiners, but rather of the American Dental Association, created under an amendment to

its Administrative By-Laws. It is, therefore, not our prerogative to create or destroy it, which fact is contrary to the opinion of some of our representatives as gathered from our annual discussions. We do, however, recommend that the National Association of Dental Examiners take formal action of endorsement of the National Board of Dental Examiners as now set up in order that our representatives thereon may possess that continued consciousness of approval which such an act would vouchsafe.

It is heard on all sides that the National Board is an illegal agency. In the light of strict definition, that is true, but it cannot be said to be unlawful. Illegal means "not in conformity with, or under the direct control of the letter of the law as administered by the courts." Unlawful means "not in conformity with the spirit or principle of the law." So the National Board is a lawful, but not legal institution. It is not legal because it has no legal status, no police powers, nor has the government, federal or state, set up any statutes for its regulation. On the other hand, it is lawful because none of its acts are out of perfect harmony with the spirit and principle of the law. The National Board has never sought to transcend any of the powers of the state boards. Their powers are supreme and guaranteed under states rights and sovereignty. The aim and purpose of the National Board of Dental Examiners is to establish a standard qualifying dental examination of such character that the certificate awarded successful candidates may be accepted by all the state boards of dental licensure as an adequate qualification for the practice of dentistry, subject to the requirements of the laws of the various states; and further to elevate the standard of qualifications for the practice of dentistry.

What it does, as just stated in its prospectus, is to give a qualifying examination, taking the applicant periodically during his student-ship career, and examining him in the basic sciences at the time when his knowledge of them is freshest and keenest; for, after all, it is as much the duty of a licensing agency to pass an applicant as it is to fail him. After the applicant has passed Parts I, II, and III,* the Board issues a certificate, which any state board may accept in part or in entirety, or may reject altogether.

The committee recommends, for those states having no legal provision for accepting the National Board's certificate, an amendment to their acts providing for its acceptance; but such amendment should carry such qualifying words as "it shall not be mandatory nor obligatory" so as to protect themselves against the possibility of any mandamus proceedings.

Since the Committee on Survey of the Dental Curriculum has completed its work, and made curriculum recommendations to the schools, there will henceforth be a more unified plan of teaching; and hence a greater uniformity in scholastic attainments of graduates. With the assurance of a greater parity of graduates from all the schools, it would be utopian if these graduates could be certified by a central licensing agency, and then be permitted to cast their lot where supply and demand dictate. As an assurance of a tonic effect on dental education, Morton J. Loeb observes: "Because candidates are from a larger number of dental schools than in any one state, the various schools have a real opportunity for comparison—the first in dental education. The examinations consequently will do much to maintain a high standard in every subject in every dental school whose students participate."

Reciprocation in the exchange of the dental license based on signed agreements as between states or nations admitting of indiscriminate travel and practice would tend to undermine organized dentistry. Promiscuous admission to practice by comity, in our opinion, should never be permitted. Recognition of license should be based upon the licensee as an individual and never upon the mass. This arrangement would free the state board from entangling alliances with other

*Subsequently, Part III was eliminated by the following rule adopted by the National Board in July 1937 at Atlantic City: "Believing that the practical examination of a candidate should properly be reserved for the respective state examining boards, the National Board of Dental Examiners hereby eliminates Part III from its program, and limits its examinations to Parts I and II, which are those covering theoretical examinations only. And be it further resolved that the National Board of Dental Examiners amend its rules and regulations and Circular of Information to effect the above-stated objective."

boards, either state or national, and at the same time would admit of a reciprocity when a worthy case presented. Under this arrangement, and under none other, should the National Board offer its licentiates† to the several states. There should be a better understanding established between the licensing agencies of the nations; not in order that our country or any other should be overrun with undesirables, to be sure, but that goodwill might prevail through a more uniform education and licensure. Is not a licensing† board for the nation the most logical means for arriving at international dental comity?

It is evident to your committee, and to you as well, that the National Board is on trial. Not in the sense that an adverse verdict would destroy it here and now; but rather that it is an illegitimate offspring of our professional body politic. Some have had the temerity to speak out in condemnation. We are confident that the opposition has arisen from misapprehension of the Board's plans and purposes. To attempt to destroy an institution such as this, founded in goodfaith; handicapped at first for lack of funds; forced to steam through uncharted seas; with no legal status to force adherence to its tenets, would be to repudiate the faith which we have reposed in its founders and members; and to deny them the time and opportunity in which to acquit themselves like men. Will you not lend them your support, and give them a chance? The National Board of Dental Examiners has not yet had time to arrive.

A minority report, submitted by Morton H. Jones, Columbus, Ohio, concludes with the following:

Since the first time that the idea of a National Board of Dental Examiners was ever mentioned, we have continually heard the plea of "give it a trial—give it a trial!" A trial is all that Red Russia wanted! A trial is all that Mussolini wanted! That is all Hitler wanted—just a trial! Give them the authority which they demand to carry out their trials, and the trial is over, because all the power is then in their hands with which to dictate future conduct. Give the National Board a trial and it will exercise the same kind of dictatorial power which these three I have just mentioned are now dictating in world affairs. . . .

Gentlemen, in the name of better dentistry, and in the name of a greater health service to the people of this country, I urge you that the resolution as introduced last year and deferred until today be unanimously adopted.

Hardly would one consider these very reasonable applications to the matter at hand. Nevertheless, the National Association of Dental Examiners voted to withdraw from the National Board, and the next day the president, W. H. Robinson, expressed regret because the body was tearing down something which existed, with nothing to substitute for it.

However, after the vote to withdraw from participation in the National Board, which had been condemned so violently in New Orleans, most of two following sessions was devoted to developing a board within the National Association of Dental Examiners; and throughout the entire argument, there was no complaint against the present board as to its methods.

Many problems arose when the National Association of Dental Examiners considered establishing its own national board. Much time and effort were devoted to the creation of a comprehensive plan, which when finally adopted was not unlike the plan of the present National Board. Financing such an organization was the greatest problem.

However, through the intervention of leaders of the profession, Contact Committees were named from all the interested participating bodies, National Association of Dental Examiners, American Dental Association and American Association of Dental Schools, because the difficulties appeared to be such as could be overcome in time. Meetings were held in 1938 and again in 1939 and, as a result, the opinions on the several points of difference in the rules and regulations were discussed. The latter were clarified and finally adopted by the National

†Should state "certifications."

Board. In these meetings, C. R. Lawrence, J. G. Hildebrand, and Albert R. Ross displayed sympathetic understanding.

In 1940, at the meeting of the examiners association, it was voted to reaffiliate with the National Board and its five representatives were again named. This did not occur, however, without considerable discussion, but, as heretofore, this was evidently the result of failure to understand the real purpose of the Board.

The future of the National Board appears bright. The interest of the representatives of the National Association of Dental Examiners since their appointment has been marked by conscientious effort, and this fact, combined with the interest of those from the American Association of Dental Schools and the American Dental Association, will bring the National Board of Dental Examiners to its rightful position in dental education and reciprocity.

That the National Board will be an important factor in dental education cannot be doubted. As previously stated, it will provide the best measurement for comparison of teaching methods throughout the country. With the cooperation of the Council on Education, the standards of the Board will prove a credit to the profession and will provide a standard for state boards, and protection for the public.

PAST AND PRESENT MEMBERSHIP OF THE NATIONAL BOARD OF DENTAL EXAMINERS

Representatives of the American Dental Association

John V. Conzett, Dubuque, Iowa
L. Pierce Anthony, Chicago, Ill.
J. Franklyn Cook, Los Angeles, Calif.
Harry W. Nelson, Minneapolis, Minn.
A. C. Wherry, Salt Lake City, Utah
*Harold W. Alden, Northampton, Mass.
*Morton J. Loeb, New Haven, Conn.
C. F. Chandler, Montgomery, Ala.
Robert R. Gillis, Hammond, Ind.
James V. Gentilly, Cleveland, Ohio
J. E. John, Roanoke, Va.

*Originally members of the N.A.D.E.

Representatives of the National Association of Dental Examiners

Alexandar H. Reynolds, Philadelphia, Pa.
Henry J. Feltus, Baton Rouge, La.
George E. Haigh, Jefferson City, Mo.
O. E. Jackson, Oakland, Calif.
W. S. P. Coombs, Middleton, Del.
H. Clay Hassell, Tuscaloosa, Ala.
W. F. Walz, Lexington, Ky.
C. Willard Camalier, Washington, D. C.
W. A. Giffin, Detroit, Mich.
T. A. Broadbent, Chicago, Ill.
George E. Burket, Kingman, Kan.
T. P. Reagan, Helena, Mont.
Walter F. Barry, Newark, N. J.
Charles J. Baumann, Milwaukee, Wis.
Wilbert Jackson, Clinton, N. C.
R. H. Nelson, Missoula, Mont.
Gordon L. Teall, Hiawatha, Kan.
H. W. Campbell, Suffolk, Va.

Representatives of the American Association of Dental Schools

A. W. Bryan, Iowa City, Iowa
DeLos L. Hill, Atlanta, Ga.
William H. G. Logan, Chicago, Ill.
A. C. McDowell, San Francisco, Calif.
Charles R. Turner, Philadelphia, Pa.
H. E. Friesell, Pittsburgh, Pa.
T. E. Purcell, St. Louis, Mo.
Floyde E. Hogeboom, Los Angeles, Calif.
C. Barton Addie, Philadelphia, Pa.
Howard M. Marjerison, Chicago, Ill.
H. L. Wheeler, New York, N. Y.

Representatives of the Federal Services

Hugh S. Cummings, Washington, D. C., Surgeon General, U.S.P.H.S.
Frank C. Cady, Washington, D. C., U.S.P.H.S.
Colonel C. T. Messner, Washington, D. C., U.S.P.H.S.

H. T. Dean, Washington, D. C., U.S.P.H.S.
Paul G. White, Washington, D. C., Navy
Ernest W. Lacy, Washington, D. C., Navy
Albert Knox, Washington, D. C., Navy
E. K. Patton, Washington, D. C., Navy
P. S. Rossiter, Washington, D. C., Navy
C. E. Riggs, Washington, D. C., Navy
M. W. Ireland, Washington, D. C., Army
Robert U. Patterson, Washington, D. C., Army
Charles R. Reynolds, Washington, D. C., Army
Frank P. Stone, Washington, D. C., Army
Leigh C. Fairbank, Washington, D. C., Army
Robert T. Oliver, Washington, D. C., Army
66 Trumbull Street.

FULL UPPER AND LOWER DENTURE REBASING UNDER MASTICATORY PRESSURE

By ERNEST C. REOCK, D.D.S., Belleville, N. J., and SAUL M. GALE, LL.B., D.D.S., Newark, N. J.

As far as we can determine, the use of wax compounds in the correction of dentures was first demonstrated by George F. Everett, of Chicago, who, with George H. Henderson, of Chicago, worked out a technic which they demonstrated in different parts of the country. H. E. Tompkins, of New York, also presented a wax compound technic about this time. These men used wax compounds of different consistencies in their technics.

Full upper and lower dentures may, in simple terms, be divided into two classes: (1) those dentures that function and look well and (2) all others. Some of the reasons that dentures fall in the second class are:

1. Faulty impressions:

(a) Impressions that do not include the full denture area.

(b) Impressions that are overextended into muscular tissue.

(c) Impressions extending into areas beyond the proper posterior border.

(d) Insufficient relief of hard areas.

(e) Lack of peripheral seal.

2. Faulty articulation:

(a) Incorrect registration of centric relation.

(b) Occlusion that does not function properly.

(c) Lack of esthetic values.

(d) Incorrect vertical dimension.

3. Changes in the alveolar process from resorption.

4. Too frequent repair demanded by old dentures.

5. Psychologic misfits.

Often dentures function and look well, but the patient refuses to wear them. This is indeed a problem to both the dentist and the patient. These cases will not be considered at this time, for obvious reasons.

In all cases except those wherein the trouble lies in faulty articulation, it is not necessary to make new dentures. The patient will obtain greater comfort and satisfaction and the result will be a great

deal better if the dentures are rebased. The materials used are hard, medium, soft and extra soft wax compounds.

1. The first, or hard wax compound, being very hard and tough, is used only as a binder for the medium wax in the upper denture.

2. The second, or medium wax compound, is slightly softer and is used when the tissues of the mouth are firm, as it softens slightly at normal mouth temperature.

3. The third, or soft wax compound, is used when the tissues are softer, as in the lower jaw.

4. The fourth, or extra soft wax compound, flows freely at mouth temperature, but is also quite brittle, giving a distinct outline to the impression, and is used in taking impressions and to correct cases wherein there is a deficiency due to the breakage of wax, etc.

Fig. 1.—Original denture.

Fig. 2.—Denture beveled and prepared for application of wax compounds.

REBASING THE UPPER DENTURE

1. The case is tested for proper occlusion, the operator making sure that there is an even, balanced occlusion in centric jaw relation. This is very important as a sliding or unbalanced occlusion will result in a distorted impression of the tissues.

2. The denture is tested for proper length. The denture should extend distally to the foveae palatinae, the two small depressions seen on the soft palate at the point of junction of the hard and soft palates. It should also extend to the trough, or depression, distally from the condyle area and anteriorly from the hamular process on each side. These troughs or grooves may be located by palpation with a blunt instrument, the dipping down of the tissue being marked at this point. These landmarks, the foveae palatinae and the grooves on each side, indicate the proper length for the denture and the area that should be covered by the denture to give a perfect valve seal in that area. Next, the denture is tested for any low muscle attachments, the operator going from one tuberosity to the other and making note of any irregularities present.

We now use a large stone (Miller's No. 20) to trim off the labial and buccal walls of the denture at the periphery, to have a clearance of at least 2 to 3 mm. completely around the denture. We then take large vulcanite burs and trim out the inner portion of the buccal and labial wall to the depth of at least 2 mm., if possible. We extend this trough over the crest of the ridge, but do not touch the palatal portion of the denture except for

a distance of about 5 mm. palatally. We never trim the palatal portion unless it is very thick or has been treated with cellophane, as we desire a rigid unyielding surface on the hard palate. The periphery is beveled for better and stronger union of the wax with the denture.

The case is cleaned and completely dried with chloroform so that the wax compound can adhere properly. The hard wax compound, which has been melted to a liquid state in a small double boiler (the wax compound is never heated over a direct flame as some of the ingredients may be destroyed), is applied with a small brush to the entire surface of the denture,

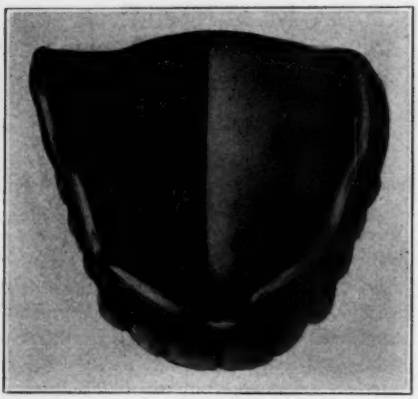

Fig. 3.—Denture with hard and medium wax compounds applied.

which will be in contact with the mucous membrane of the mouth. Another thin coat of the hard wax compound is applied, the operator making sure that the border is completely covered. The medium wax compound is added, being painted on in the same manner as the hard wax compound, but with a trough about 5 mm. wide left at the crest of the ridge. At this time, the medium wax compound is not painted on the labial portion from cuspid to cuspid, to avoid protrusion. The trough permits freedom of the ridge and allows the surplus wax compound to crawl down and give a good natural impression of the ridge without any distortion. After the wax is applied in this manner, with consideration for the amount of absorption originally under the denture, the waxed case is placed in hot water (about 140° F.) until such time as the wax turns yellow, which denotes that the wax is of even temperature and texture throughout and the denture will therefore seat itself more easily and with less danger of distortion of the tissues and consequent loss of balance in the finished denture.

The case is then inserted in the mouth and the patient is instructed to close the jaws together with a snap, causing a

Fig. 4.—Denture after being worn by patient for period of twenty-four hours.

pounding of the denture on the tissues resulting in an even distribution of the wax compound and a perfect impression. This procedure is continued for about twenty minutes, after which the case is removed and examined to determine whether more wax is required and the case has been properly trimmed at the periphery.

The case is now dried with air and examined carefully. Where the case has been in contact with the tissues, the surface of the wax compound will appear shiny. Where there is a lack of contact, the surface of the wax compound will appear dull and lusterless. More medium

wax compound is added to the deficient areas and the case is tempered in the hot water again and inserted in the mouth. The patient is instructed not to remove the case and not to eat or drink anything that is very hot, as this may alter the wax compound. He is instructed to pound the denture on the tissues whenever an occasion presents itself and also to work the muscles of the face so that the muscular attachments will be allowed for in the finished case.

The patient is dismissed for twenty-four hours and, on his return, is questioned as to whether the denture has been tighter, comfortable and stable and whether he is satisfied. The denture should not be tested by pressure on the

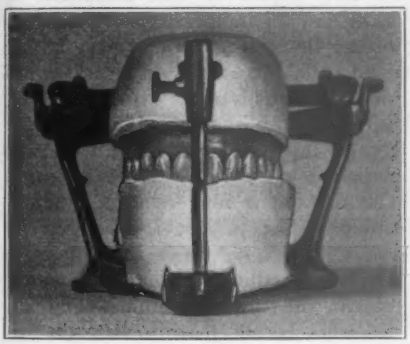

Fig. 5.—Wax rebased denture mounted on articulator.

labial or buccal flanges, as this will distort the wax. Compressed air is used or the patient is instructed to distend the cheeks and blow, or flood the mouth with cold water when removing the case from the mouth. The waxed-up denture should present a brightly polished surface at this time.

After removing the denture, we examine it to see that there are no small portions of wax compound broken off and to determine whether there are any portions not in contact. If any are present, a little of the extra soft wax compound is applied; the denture is replaced in the mouth and the patient is instructed to pound it in, using a chopping motion. In this manner, any deficiency can be corrected at the chair in a short time.

When the impression is satisfactory, the denture is boxed carefully and a stone model poured. The model with the case intact on it is attached to the upper half of the articulator, which has a pin in the anterior portion so fixed that there is no movement of the upper frame of the articulator or the teeth. All guides and pins are set securely. Then a plaster index is built up over the lower half of the articulator. The upper frame is removed and the case placed in hot water for a

Fig. 6.—Case with old denture material removed and teeth reset in index.

few minutes to soften the wax and the denture so that it can be removed easily. The denture is placed in boiling mineral oil for ten minutes to soften the vulcanite sufficiently to make removal of the teeth possible without danger of breakage.

The removed teeth are washed in soapy suds to remove any trace of the oil and dried with chloroform. The cast is replaced on the articulator. A new baseplate is adapted, as for a new denture. A tooth is placed in its index in the opposing jaw of the articulator; some wax

is added to the tooth and the articulator is closed so that there is contact with the base-plate. The wax is luted and tested to assure that the tooth seats itself accurately in its index. This procedure is followed with the remaining teeth.

In case of immediate insertion of the denture, after extraction, it may be necessary for appearance or efficiency to reset the anterior teeth. This may be done at this time.

The case, when completed, should seat itself in the index without any interference. If it does not, there has been an error in the technic.

When cases are inserted after being out of the mouth for a day or two, there is usually looseness of the denture, owing to the fact that the tissues have been compressed for a period of twenty-four hours; and when the dentures have been out of the mouth for forty-eight hours and are then inserted, they will feel loose for about two hours, after which they will become tight.

The method described gives as nearly a perfect fitting denture as it is possible to obtain, as it assures an impression based on the condition of the tissues over a period of twenty-four hours, during mastication and all other functions; while the ordinary impression is taken over a period of about one hour or less and, at most, only gives an impression of tissues not in function, except at that particular moment. The method automatically relieves any hard areas and the anterior and posterior palatine foramina, and fills in the labial and buccal vaults.

We have found this method advantageous when unable to obtain a good impression of the tissues owing to the nervousness, ill-health or unfavorable conditions of the patient. In cases of that kind, we get the best impression possible and make up the case. The patient wears the denture for a week or more, or until accustomed to it. We then rebase the denture as outlined above and proceed with the finishing of the case. A perfect impression for a gold or any metal case can be obtained with the foregoing method.

REBASING THE LOWER DENTURE

The lower denture is prepared in approximately the same way as the upper, the labial and lingual flanges being trimmed first to allow for muscle attachments. The portion over the crest of the ridge is so trimmed as to have a clearance of about 2 mm. over all.

The case is thoroughly dried and the medium wax added as a binder, over all the surface that is to be in contact with the tissues. The soft wax compound is painted over all but the crest of the ridge, so that there will be ample room for any surplus of wax compound to crawl and fill in the space without distorting the ridge. If the crest of the ridge is flabby, a little of the extra soft wax compound is used.

The denture is tempered in water 105° F. and inserted in the mouth and the patient is instructed as above indicated. The denture is now removed and examined. The patient is dismissed for about eight hours with instructions as previously outlined. When the patient returns, the case is examined and any deficiency corrected with extra soft wax compound.

The case is invested upside down in the flask, covering all but the waxed-in portion. When the plaster has set thoroughly, the other half of the flask is poured in stone or hard plaster. The two halves of flask are separated. The wax compound is washed out, and the rubber surface serrated with a No. 16 wheel bur and cleaned with chloroform to remove all wax compound. Waste gates are now made and the case packed the same as a new case and finished, the operator being sure that the flask is entirely closed around the periphery, as failure to close it will ruin the case.

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THE JOURNAL *of the* AMERICAN DENTAL ASSOCIATION

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CANCER PREVENTION

THE long-recognized fact that the mouth is one of the commonest locations for cancer in the human body has placed an obligation toward the prevention of this dread disease on the dental profession in common with the medical profession in the matter of diagnosis; a responsibility which, in the light of the modern trend of dentistry toward development from the biologic point of view, should be readily accepted and seized upon as a means of discharging the larger obligations which the biologic relationship imposes upon the profession.

The frequency and seriousness of malignancy of the mouth are vividly and tragically portrayed in a recent report in the medical literature of a study of 556 cases of cancer of the tongue in which the author states that cancer of the tongue is more often fatal than any other malignant growths of the mouth, head and neck. A considerable percentage of these malignancies were first seen by the dentist, and only about 10 per cent of those seen first by the dentist were recognized by him as potentially cancerous. It is estimated that some 155,000 deaths occur from cancer each year in the United States, and of this number more than one-half could readily have been avoided if treatment

had been instituted at the proper time. Of this number of deaths, it is conservatively estimated that 5 per cent are from cancer in and about the mouth, in areas which come within the purview of the dental surgeon, and might readily have been discovered early enough to prevent the usual serious outcome.

Much progress has been made in the medical field toward control and cure of cancer, and a widespread and increasing interest on the part of the public is being enlisted in the general effort to prevent this intractable disease, but the number of cases occurring each year shows no particular sign of decreasing; in fact, there is an increase from year to year even though the methods of treatment are increasingly successful. Until the efforts toward a thorough understanding of the etiology of malignant conditions are more successful, the greatest hope lies in the early discovery and treatment of the lesions which lead to cancer. And it is from this approach that the dental profession can be of material aid in the discovery, control and cure of these conditions.

It is fortunate that these lesions which occur in the mouth usually exhibit symptoms early and can thus be recognized in the early stages by the patient, the physician and the dentist; but the obligation and opportunity of recognition rest heavier on the dentist in many cases occurring in areas which are constantly under his surveillance.

The cancer danger signals, usually painless symptoms, which may mean that cancer is present or threatening are: any persistent lump or thickening; any irregular bleeding or discharge from any body opening; any sore that does not heal normally, especially about the tongue, mouth or lips, and any sudden change in the form or rate of growth of a mole or wart. In the great majority of cases of developing cancer, these danger signals are present in ample time to be referred to the physician for a precautionary examination.

Almost any papilloma, area of leukoplakia, swelling, induration or ulceration or lump in the oral cavity is readily recognizable by the patient and is susceptible of diagnosis by the physician almost from the moment of appearance. Almost any fissure, induration, ulceration or swelling of the lip can be seen and felt and diagnosed immediately.

The inevitable conclusion, then, is that development of cancer and failure in the treatment of cancer of the mouth are due almost entirely to ignorance, neglect or lack of alertness at the very beginning. It is quite evident that there is an unusual opportunity as well as obligation on the part of the dentist in the education of the public and in an in-

crease in alertness, knowledge and sense of responsibility to his clientele. Cancer of the lip can begin as a simple fever blister, and this area is under almost constant observation by the dentist in his ministrations in the oral cavity. It is then incumbent on the dentist to call attention to such lesions and to direct the patient to consult a physician if any lesion of the lip does not heal within two weeks.

The therapy of cancerous lesions is another phase of the subject which vitally concerns the dental operator. Paradoxical as it may seem, the roentgen rays, which are one of the therapeutic means of controlling cancer, can be the cause of, if not cancer, a cancerous condition, resulting from too close and too long contact with and exposure to the action of the rays. The interest of the dentist, in cancer then, is twofold—to aid others in avoiding these dangerous lesions and to avoid them himself. We have had a number of instances in dental practice of the serious consequences of carelessness and lack of knowledge in regard to the use of the x-rays as an adjunct to dental practice.

Another fortunate peculiarity of cancer of the mouth, and one that should give much encouragement to the dentist who really has the welfare of his clientele in mind, is the fact that malignancies of the mouth and face are more amenable to therapeutic measures than those in other parts of the body. Cancer of the tongue, however, is an exception to the rule, and, probably because of the nature of the tissues and the blood supply of the tongue, is more often fatal than that in other areas about the mouth. It is in these cases that the dentist can be of invaluable aid, in discovering a potentially cancerous condition in its early stages. Malignancy of the tongue can develop much more rapidly and can reach the inoperable stage more quickly than malignancy in any other tissues, and one who has been in contact with an aggravated malignancy of the tongue can well appreciate the desirability of its discovery in time to avoid the metastatic stage—the most serious phase of cancer of the mouth and lips.

Because of the fact that he has the oral cavity under constant surveillance and, too, because he is in position to see cancerous lesions in and about the mouth long before the attention of the physician would be directed to them, the dentist should thoroughly familiarize himself with the characteristic symptoms and appearance of these lesions in their incipient stages.

An unfortunate feature of cancer, and one that should be impressed upon the patient, is that the principal subjective symptom is pain, but

when the pain stage is reached, the condition is most likely beyond hope of curative treatment.

Dentistry is constantly endeavoring to broaden its scope as a health service; and in the rôle that he can play in safeguarding his patients from cancerous lesions of the mouth, the dentist has the opportunity to become an invaluable aide to the medical profession, rendering a most important and valuable health service to humanity.

DENTISTRY AS A PROFESSIONAL CAREER

ONE of the first problems that attracted the attention of the new Council on Dental Education soon after its organization and determination of its program was the decreasing number of young men yearly seeking to enter the profession. Accordingly and in line with its declared policy of serving the profession in all its educational phases, it has given serious study to the question and, in a special brochure just issued, has endeavored to alleviate this more or less distressing state of affairs.

The main purpose of this informational brochure is to help parents, youth and guidance officers to appraise the field of dentistry and the opportunities it offers for a professional career. Dentistry is rapidly becoming recognized as an indispensable branch of the great healing art, one whose services to humanity will be enlarged as its scope of health service is enlarged and which promises exceptional rewards in the satisfaction that can come to one who dedicates his life in its professional aspects to humanitarianism.

It is interesting indeed to note that a philosophy of dentistry has been developed by the Council such as befits dentistry and one that justifies our claim to being a skilled and specialized health profession. Too long we have been hiding our light under a bushel, to the extent that each year a decreasing number of young men have recognized and appreciated the opportunities afforded for a useful professional career in health service.

The Council has in this brochure presented in a most interesting and instructive manner a brief story of the development of dentistry. The practice of dentistry, however, is not portrayed as a sinecure with rewards out of proportion to the effort expended. On the other hand, the practice of dentistry is portrayed as a profession which, in its preparatory stages, demands long hours of effort and study and, in its practice, long and tedious hours of application and effort.

The brochure sets forth to professional educational circles the advantages, the opportunities, the emoluments, the rewards and the perquisites mental and material of a life devoted to the ideal of service to one's fellowman.

The brochure in no sense represents a recruiting effort on the part of the Council. It presents the case for dentistry as an opportunity in a manner that is intended to aid the professionally inclined young man in deciding for himself as to whether he wishes to pursue a dental course.

BIBLIOGRAPHICAL

Pierre Fauchard: Surgeon-Dentist

By B. W. WEINBERGER, D.D.S. Cloth. 102 pages. Price $3.50. Pierre Fauchard Academy, Minneapolis. 1941.

THIS is a brief account of the beginning of modern dentistry, a description of the first dental textbook and of professional life 200 years ago. This volume has been attractively prepared and illustrated from the original cuts appearing in Fauchard's Le Chirurgien Dentiste, which was written in 1723, but not published until 1728. An account of Fauchard's early life and development are given, together with a description of certain of the more pertinent portions of Fauchard's book. It presents little new information on this great man, but it is a most attractive and readable little volume, eminently suitable as a gift to a booklover.

Your Teeth. Their Past, Present and Probable Future

By PETER J. BREKHUS, B.A., D.D.S., Professor of Oral Diagnosis, School of Dentistry, University of Minnesota. Cloth. 247 pages. Price $2.50. The University of Minnesota Press, Minneapolis. 1941.

PETER J. BREKHUS has written an exceedingly interesting and useful book covering the broader aspects of dental disease. An attempt is made to evaluate the health of the mouth and jaws in relationship to other conditions as determined by the physical anthropologists. Thus, the relationships between general and dental development and the effect of foods and chewing exercises on the strength of the jaws are interestingly described. One of the best sections in this volume is that devoted to dental disease among animals and the origin and development of the human dentition. Much of the material reported is original work by the author, but adequate use has been made of other sources also. Each chapter is followed by a brief but pertinent bibliography. Although considerable difference of opinion may prevail on the interpretation of the data presented in discussing these controversial problems, the book is so interestingly and clearly written as to provide very stimulating reading. It can be heartily recommended to those interested in the broader aspects of disease and particularly dental disease.

Oral Pathology

By KURT H. THOMA, D.M.D., Professor of Oral Surgery, and CHARLES A. BRACKETT, Professor of Oral Pathology, Harvard University. Cloth. 1284 pages, with 1370 illustrations. Price $15. The C. V. Mosby Co., St. Louis.

THIS monumental undertaking, although a new work, incorporates much of the material previously published in Dr. Thoma's books. The volume is divided into twelve parts, each dealing with a specific phase of oral pathology. An innovation in a book of this type is the first section, which presents 125 pages on experimental oral pathology

and the use of animal material in elucidating certain dental problems. The most conclusive results in this field have been obtained in studies of the relationship of vitamin deficiencies to tooth development, the effects of the endocrines on tooth development and the normal growth of the teeth. These facts are carefully evaluated and described. The next sections deal with the developmental anomalies of the teeth and of the head and functional and acquired injuries to the teeth. In these chapters, the association between skeletal abnormalities and mouth and jaw abnormalities is stressed. Growth and development of the body and the jaws as an associated part come in for their share of attention. The diseases of the jaws are discussed after those of the teeth. Tumors of the hard and soft tissues of the jaws are taken up in sequence, and the volume closes with a section on diseases of the salivary and mucous glands. Following each chapter is an adequate bibliography of the material quoted. Several criticisms may be applied to this book. As a textbook, it is much too large and complicated. While an attempt is made to integrate diseases of the mouth and jaws with systemic disease, in some sections the author lets the reader lose perspective in his strict attention to this point of view. For example, in a discussion of the causes of discoloration of the teeth, jaundice and hematoporphyrinuria, very infrequent causes are mentioned, whereas the common local effects from necrotic pulps and various filling materials are omitted. In statements to the effect that hyperthyroidism may cause teeth to be bluish white; hypothyroidism, milky white; hyperpituitarism, grayish yellow, and suprarenal function, yellow, the author is probably not only indulging in romantic speculation, but is also conveying the erroneous idea that these color changes may be useful as diagnostic aids. The colored photographs utilized are in general, of poor quality and the photomicrographs are exceedingly poor. The latter pictures are frequently reproduced at such a low power as to show nothing except pink dust in a more or less azure field. For a textbook, these pictures should be larger and more informative. On the positive side of the ledger, this volume presents a comprehensive attempt to treat the mouth as a portion of the body. As a reference work or text for graduate students, it should be of considerable worth, and in presenting the broader aspects of dental disease to undergraduate students, it will be of great help.

Building a Dental Practice

By EDBERT AUSTIN SMITH, D.D.S., F.A.C.D. 51 pages. Cloth. Price $1. American Book—Stratford Press Inc., New York. 1941.

ONE of the outstanding needs of the graduates of our dental schools, as they enter upon their professional careers, is guidance (more or less detailed) regarding the steps necessary to the building of a successful practice. Shall they locate in a city or one of the smaller towns in the country? What is required in the way of office equipment? How important is it that the beginner should have an office assistant? What consideration should be given to his service to the profession, to his health and to preparation for old age or possible retirement? These are all highly important questions to the young man as he engages in his life's work. And nowhere can he find a more satisfactory answer to all these questions and a multitude of others affecting his success in practice than in this book by Dr. Smith. Few practitioners are so well equipped as he to offer advice along these lines. "During forty-two years of dental practice," it is stated in the foreword, "half of which time was spent in a town of under 30,000 inhabitants, and the latter half in New York City, the writer has trained many young men for future practice. So many little things have happened that have meant either added practice or loss of clientele, so many seemingly inconsequential things, either words spoken or deeds performed have been the beginning of success or failure, that it has seemed that a book should be available for the senior students and the young practitioner that would steer him through his early years without some of the bitter, costly occurrences which older men have experienced." It was with this in mind, that "Building a Dental Practice" was written. It amply fulfils its purpose and could be read with profit by every recent graduate in dentistry.

ARTHUR H. MERRITT.

ASSOCIATION ACTIVITIES

Contents

PRESIDENT'S PAGE

Rehabilitation 1332

COMMITTEE ON DENTAL PREPAREDNESS

Commissions in the Dental Corps 1334

COUNCIL ON DENTAL THERAPEUTICS

Py-Ro—Not Acceptable for A. D. R. 1338
Accepted Dental Remedies 1341

COUNCIL ON DENTAL EDUCATION

Dentistry as a Professional Career 1342

BUREAU OF PUBLIC RELATIONS

Education for Family Life 1344
Cancer of the Mouth 1345
Mouth Health in the Magazines 1349
Accidents Occurring in High School Athletics. Leon R. Kramer, D.D.S. 1351

COMMITTEE ON LEGISLATION

California Physicians' Service 1352
Bills Barring Professions to Aliens Vetoed 1352
Dental Services as Medical or Surgical Within Workmen's Compensation Statutes. Leslie Childs 1353
Laboratory Advertising Restrictions Upheld by Illinois Supreme Court 1355
Dental Bill Signed by Governor 1356
Ohio Amends Dental Law 1356

A. D. A. ANNUAL MEETING

The Houston Meeting 1357
Hotel Reservations.—Schedule of Rates 1359, 1360

AMERICAN DENTAL ASSOCIATION MEMBERSHIP

Membership Percentage Chart 1361

NEWS ITEMS

Report of the Commission on Physical Rehabilitation 1362
A. M. A. Trial 1364

CORRESPONDENCE

"Osteomyelitic Conditions of the Mandible" 1364

OBITUARIES

R. D. Griffis, D.D.S. 1366
Deaths 1366

President's Page

To the Members of the American Dental Association:

IN the last two issues of THE JOURNAL, the President's Page was used to discuss the work of the Dental Preparedness Committee of the American Dental Association, the status of the Murray bill and the latest developments in the program of the Selective Service System.

This month's page will comment on still another problem that confronts the profession at the present time. It deals with the rehabilitation of the young men who are about to be drafted into the armed forces of our country.

It is well known, of course, that many registrants under the Selective Service and Training Act of 1940 have been rejected for active military service because of dental defects. The large number of such rejections has been a matter of grave concern to officials of the American Dental Association as well as to our military authorities. A good deal of study has been devoted to the development of a practicable plan through which the correction of dental defects, either before or after the registrant has been examined by his local draft board, can be promoted.

The problem of rehabilitation, in its initial stage, proposed certain questions of a jurisdictional nature in addition to many others. Was a program of rehabilitation to be set up by the Selective Service System or was such a program to be developed by the American Dental Association in consultation with proper governmental agencies? What types of dental care would be made available under such a program?

By whom and under what conditions was dental care to be provided for a deficient registrant? Was the financial burden of such a rehabilitation program to be borne by the dentist, the registrant himself, the government or the organized profession? The answers to these questions have an important influence on the health of those eligible for military service and upon the extent of the contribution to be made by the organized profession in a time of national need.

The question of rehabilitation was raised by officials of the Selective Service System in a letter to the Dental Preparedness Committee of the American Dental Association. As no committee had been officially authorized to deal with this specific problem, C. Willard Camalier, chairman of the Dental Preparedness Committee, wrote

to the President of the American Dental Association to ask whether the development of the rehabilitation program was the responsibility of that committee.

Inasmuch as machinery had already been set up in the form of the National Health Program Committee, which had the approval of the House of Delegates, the President felt that this problem came under its jurisdiction. This information was conveyed to the chairman of the Dental Preparedness Committee. At the same time, the chairman of the National Health Program Committee was instructed as to the committee's responsibility in this matter.

Acting on these instructions, the National Health Program Committee met in Chicago, June 29, to discuss the assignment of the President. Those present were Harold W. Oppice, chairman, L. T. Hunt, Leroy M. S. Miner, Raymond M. Walls, Lon W. Morrey, Gerald D. Timmons and Harold Hillenbrand. The problems involved in a rehabilitation program were discussed.

The committee voted to ask the President to place officially before the proper governmental and military authorities an offer of wholehearted cooperation on the part of organized dentistry in the solution of this problem. Accordingly, letters over the signature of the President were sent to Paul V. McNutt, Coordinator of Health, Welfare and Related Activities in the National Defense Program, to Thomas Parran, Surgeon-General of the United States Public Health Service, and to Lewis B. Hershey, acting director of the Selective Service System. These letters called the attention of the respective officials to the fact that the American Dental Association recognized the need for effective plans for the prehabilitation and rehabilitation of Selective Service registrants. The assistance and cooperation of the National Health Program Committee in developing such programs were made immediately available to these governmental agencies. It was also pointed out that the program approved by the House of Delegates for the participation of organized dentistry in the expansion of a national health program was immediately applicable to the problems at hand.

From this, it can be seen that the American Dental Association is making available all of its resources in a time of national emergency. Beyond a doubt, the entire profession will respond individually and collectively in the wholehearted manner that it has in the past.

Wilfred H. Robinson.

COMMITTEE ON DENTAL PREPAREDNESS

WITH further reference to the matter of granting commissions to dentists inducted under the Selective Service Law, the Committee on Dental Preparedness presents below the Directive of the Adjutant General of the Army, dated June 20, 1941, and designed to cut "red tape" in order that the commissioning of qualified dentists who have been inducted may be facilitated. It is believed, from inquiry, that no unreasonable time will elapse between induction and the granting of the commission provided all participants in the arrangement will do their part to see that the applications are not unduly delayed. It is noted that the War Department recognizes the assistance that the American Dental Association can render in furnishing certain information relative to the candidates. In this connection, the Committee on Dental Preparedness feels confident that its organization, functioning through the Central Office of the American Dental Association, with the data available from the questionnaires now on file there, and with the assistance of the State Military Affairs Committees, will respond promptly and thoroughly to calls made upon it by the War Department. This routine is in line with the service already rendered by the Committee on Dental Preparedness to the American Red Cross and the military services in checking the applications for enrollment of dentists, dental hygienists and mechanics.

WAR DEPARTMENT
The Adjutant General's Office
Washington

May 5, 1941

Subject: Appointment in the Dental Reserve of Inducted Individuals.
To: Each Chief of Arm and Service.

1. The following radiogram has been sent this date to the Commanding Generals of all Field Armies, Corps Areas, and Departments.

INDIVIDUALS WHO ARE QUALIFIED FOR APPOINTMENT IN THE DENTAL CORPS RESERVE WHO HAVE BEEN INDUCTED UNDER THE PROVISIONS OF THE SELECTIVE TRAINING AND SERVICE ACT OF NINETEEN FORTY SHOULD BE ENCOURAGED TO APPLY FOR APPOINTMENT IN ORDER THAT THEY MAY SERVE IN A PROFESSIONAL CAPACITY. INDIVIDUALS ACCEPTED FOR APPOINTMENT WILL BE DISCHARGED AND ORDERED TO EXTENDED ACTIVE DUTY FOR A PERIOD OF TWELVE CONSECUTIVE MONTHS.

By order of the Secretary of War:

E. S. ADAMS,
Major General,
The Adjutant General.

WAR DEPARTMENT
The Adjutant General's Office
Washington

June 20, 1941

Subject: Appointment in the Dental Corps Reserve of Inducted Individuals.
To: Commanding Generals Each Army, Corps Area and Department.

1. With reference to the War Department radiogram of May 5, 1941, file AG 210.1 O.R.C. (3-25-41)R-A, which directed that inducted individuals who were qualified for appointment in the Dental Corps Reserve . . . would be encouraged to apply for a Reserve commission, further instructions are herein announced.

2. In order to expedite action upon applications for commissions in the Dental . . . Corps Reserve of qualified individuals who have been inducted under the provisions of the Selective Service and Training Act of 1940, the following procedure will be followed:

a. Each application accompanied by a *final type physical examination* will be forwarded through local stations or camp commanders to the Commanding General of the Corps Area in which the applicant is serving, who, without reference to the Corps Area of permanent residence of the applicant, will approve or disapprove the application submitted. If approved, the Corps Area Commander will refer the application

to an examining board, convened at the station of the applicant, who will conduct the examination as provided in paragraph 21, AR 140-5.

b. The general scope of the examination will conform to the provisions of paragraph 23, AR 140-5. To expedite the action of the board, the president thereof will communicate direct with the Corps Area Dental Officer . . . at the Headquarters of the Sixth Corps Area, with the request that he secure from the American Dental Association . . . the information outlined by paragraphs 23b, 23c, and 23d, AR 140-5, which cannot be obtained from the candidate or from local sources. Owing to the fact that the candidate may have been inducted soon after graduation, the provisions of paragraphs 6c (2) or 6c(3), AR 140-33, as applicable, will be waived.

c. The examining board will act promptly upon each application. The report of the board with the accompanying papers, will be forwarded direct to the Corps Area Commander who has convened the board. After appropriate action by the Corps Area Commander, all papers will be forwarded to the Adjutant General for final action, using "immediate action" stationery.

3. After appointment has been accomplished, extended active duty will be effected in the following manner:

a. Upon receipt of proper notification that the individual has accepted the commission tendered him, the Adjutant General will direct the appropriate headquarters to discharge the newly commissioned officer from his enlisted status upon a specified date for the convenience of the Government.

b. The Adjutant General will furnish notification of the appointment to the Commanding General of the Corps Area wherein the newly commissioned officer indicated permanent residence, and will direct that necessary orders be issued to order the officer from his temporary address where he was discharged as an enlisted man to extended active duty for twelve (12) consecutive months at a station to be designated by the Corps Area Commander issuing the orders. The effective date will be specified by the Adjutant General, and will be the day following that of discharge from enlisted status. The officer will be chargeable to the quotas allotted to the Corps Area. If no vacancy exists to which the officer could be charged, he will be ordered to extended active duty as an excess officer.

4. The Corps Area Commander will maintain a record of officers ordered to duty in excess of existing quotas—and will permit a like number of Reserve officers of the same grade and section to revert to an inactive status upon completion of current tours of extended active duty, provided at that time these officers are still considered to be in excess of the then authorized quotas.

By order of the Secretary of War:

E. S. ADAMS, *Major General*
The Adjutant General

The Committee on Preparedness has urged, and it has been recommended by the Surgeon General's office, that some suitable procedure be established for issuing commissions to dentists prior to actual induction, but this suggestion has not been acted upon. The natural question, "Why does the War Department not grant commissions to dentists before induction?" has been asked frequently.

The answer, in simple terms, is that the War Department states that there are sufficient dentists at this time, in active service and the Reserve Corps, to serve the preparedness program under the tables of organization for the next year. However, events of startling significance are so frequent now that the whole picture may change within a very short time; in which case, it may be that the reserve corps will be reopened, so that dentists with low call numbers, or others, may again apply for commissions. In the meantime, the department has agreed to commission all qualified dentists not deferred by their local draft boards as necessary under the occupational category established by Selective Service. While all of us would like to see the ideal situation, it is well to bear in mind that deferments and commissions in these cases are predicated on the principle of *need* to our civilian population and the

armed forces, and it is because of this that other groups, such as lawyers, are neither deferred nor commissioned except in a comparatively few specific instances. Incidentally, reports reaching this committee indicate that the large majority of dentists are being deferred by their local or appeal boards under the provisions of the telegram of General Hershey calling attention to the "over all national shortage of dentists." It would seem, therefore, that the number of dentists to be commissioned as a consequence of induction will, at this time, be relatively small. The names of drafted dentists that have been brought to the attention of this committee have been forwarded to Brig. Gen. Leigh C. Fairbank for consideration.

The committee desires to call attention to the fact that *every* dentist applying for a commission will not be approved. Each applicant must satisfy the War Department that he is not only physically fit, but also has the professional qualifications for acceptable military service. This would have been true if the Murray Bill, as amended, had been enacted into law. It is not practical nor desirable to grant blanket commissions to any group, and it is never done.

Concerning the dental student, the situation seems to be well in hand. Reports received by the committee indicate that local boards have a fine conception of the necessity of maintaining dental education and are acting to ensure the constant flow of dentists into the armed forces and civilian population of the nation, by deferring students as urged by General Hershey. Dental teachers, the committee is assured, are also being deferred in meritorious cases. However, in order to be very sure that the fine relationships existing between students and draft boards may not be unduly disturbed, the committee felt it wise to forward the following letter to the deans of all dental schools:

June 23, 1941

The Committee on Dental Preparedness takes this opportunity to call to the attention of the deans of dental schools the reports reaching the committee that the attitude of some dental students in assuming that local boards must defer them has created antagonism between them and the local boards. This has not only reacted against the student personally, but also may affect their school as a whole.

In connection with this situation, the chairman of the committee received a communication from a state military affairs committee chairman, part of whose letter it quoted herewith: "After our telephone call of yesterday, one of the main points impressed upon my mind was the possible attitude of the student toward the deferment which has been granted him. I immediately made a certain contact and was confidentially told several things, the most important of which was that most of the students had assumed a pretty cocky attitude. They feel that this is an order and that they are absolutely safe from induction."

This regrettable situation is called to your attention in order that you may exert every effort to prevent the display of such an attitude by your students, and to remind you also that students in the low scholarship brackets, who offer little promise of excellence in the profession, should not be recommended for deferment. While it is unnecessary to caution our schools in this respect, it is well to emphasize the importance of establishing cordial relations, based on confidence, with the local boards.

It must be remembered that the memorandum issued by General Hershey, to state selective service directors, is not an order. The memorandum points out only that the "growing over all national shortage" in dentistry is alarming and also emphasizes that portion of the Selective Service Regulations which may be utilized to provide deferment for dental students. *The final decision on matters of deferment rests entirely with the local boards* and the board should not be antagonized by students seeking deferment, nor urged to defer those whose records suggest incompetency.

The responses were all of an optimistic and appreciative character. The follow-

ing excerpts from some of them should prove interesting to the profession:

Before school closed, the student body had definite instructions from myself to call on the board where they were registered to ascertain whether there were anything that should be done concerning their registration before they departed for the summer and they were given specific information with respect to the authority of the local boards. I hope that none of our students were in the group of which you spoke in your letter.

You and your committee are to be congratulated upon the interest that has been manifested on the problems of the schools.

I am in receipt of your letter of June 23 relative to the deferment of dental students and their attitude toward the Selective Service System.

I wish to state that the matter contained in your letter has always been impressed upon our boys. They realize that they have to comply with the requirements and regulations of the Selective Service System at all times and that they must conduct themselves as young professional men are expected to.

They have been told that their deferments rest entirely with the local boards and depend upon their scholastic standings.

Every effort is being put forth to make these boys realize the opportunities which are being afforded them at this time.

We have impressed upon our student body the importance of making the proper contact with the local boards; however, we shall send another letter to the students requesting them to be very careful in making their first contact with their local board.

The only difficulty we have had was in regard to young graduates whom we wished to retain as teachers in the school. However, a letter from C. Raymond Wells to the state office in . . . has brought a fine response. They called me over the telephone and offered their services wherever they were needed. They have sent personal representatives to the boards having such cases in charge.

Ordinarily you don't expect people to answer "round robin" letters. However, yours of June 23, 1941, to the deans of the dental schools was so well arranged and decidedly to the point, that I believe it deserves an answer. I do hope that all deans take your advice and act accordingly.

About the time General Hershey's memorandum (1-99) was issued, someone in the Dental Trades Association notified all of the supply houses out here to the effect that a recent decision in Washington required that all dental students were to be given deferment. I just about caught on in time, so far as the students of our school were concerned. We assembled our students on about the last day of school and explained very thoroughly that the matter of deferment was an individual problem and that the draft boards had entire jurisdiction. I was particularly anxious that students would not contact the draft board with the "cocky attitude" you speak of in your letter of the 23rd.

We are pretty fortunate in that I arranged the registration so that all students of this school become responsible to but one draft board. After working with the members of the board for a little while, they finally classified the last of the students of this school in various deferred classifications.

I am indeed happy to know that you sent your letter of explanation to all deans.

As stated heretofore, the committee would appreciate any suggestions or constructive criticism from members of the profession, in order that any unfavorable conditions that may exist might be corrected by taking the matter up with the proper government authorities. The committee has been grateful for the opportunity to serve in those instances which have come before it, and in this connection it has had the wholehearted support of the government officials. It has tried to reciprocate when ever called upon. For the information of members of the profession who may not be aware of it, the following named officials are intimately concerned with the dental preparedness problems of the nation in their respective departments.

War Department: Brig.-Gen. Leigh C. Fairbank, (DC), Chief, Dental Division, Surgeon General's Office.

Navy Department: Capt. Albert Knox, (DCUSN), Chief, Dental Division, Bureau of Medicine and Surgery.

Selective Service System: Lieut.-Comm. C. Raymond Wells, (DCUSNR), Chief Dental Officer, 21st and C. Street, N. W.

COMMITTEE ON DENTAL PREPAREDNESS
C. WILLARD CAMALIER, *Chairman*

COUNCIL ON DENTAL THERAPEUTICS

PY-RO—NOT ACCEPTABLE FOR A.D.R.

Report of the Council on Dental Therapeutics of the American Dental Association, authorized for publication.

THE Council's report on Py-Ro (The Cable Company) was submitted to the firm in order that it might have an opportunity to present scientific evidence on behalf of the product. An examination of the firm's reply, including an attached "Brief for Respondent," apparently submitted to the Office of the Solicitor, United States Post Office Department, has been made by the Council referee.

The firm did set forth in essence that (a) it no longer uses the designation "Modified Dakin's Solution"; (b) the analytical findings of the Bureau of Chemistry are at variance with other findings, and (c) claims for Py-Ro have been substantiated. It is the referee's opinion that the matter submitted does not constitute evidence on which a revision of the report may be made in the light of the Council's published rules. In this, the Council concurs. The original report is therefore presented for the information of the dental profession.

Dentists have long used a variety of drugs as adjunctive agents in the treatment of Vincent's infection and of various forms of periodontoclasia. Many of these drugs, together with notes on limitations of use, have been described in textbooks on dental materia medica and in Accepted Dental Remedies. All competent practitioners of dentistry know that the use of drugs alone, even when these are applied by the dentist, is inadequate for the treatment of Vincent's infection and periodontoclasia. There is, in fact, no "specific" cure for Vincent's infection or for pyorrhea alveolaris. This is not surprising in view of the complex etiologic picture in these diseases. Since these topics have been discussed in a large number of textbooks and scientific publications, they will not be considered at length in this report.

It is a matter of record that individuals and firms unhampered by scientific or professional restraints have, from time to time, foisted "sure cures" for pyorrhea and for Vincent's infection on the public. Not uncommonly, the same agent has been advocated for the treatment of the two diseases. Occasionally, other unrelated conditions have been included in the advertising propaganda.

Typical of the nostrums that have been offered the public in the past is the product Py-Ro (Cable Products, Hamilton Grange Station, New York). In magazines and package circulars, this preparation is advanced as a sure cure for "pyorrhea" and trench mouth in these words: "Stops Pyorrhea and Trench Mouth or no cost."

On package labels of Py-Ro distributed in 1939, the product is described as "An antiseptic for treatment and prevention of pyorrhea, trench mouth, bleeding gums, cankers, mouth sores." These broad claims have been removed

from the package label of the product currently sold; probably to avoid conflict with the provisions of the Food, Drug and Cosmetic Act. In one form or another, these claims have, however, been transferred to magazine advertising directed to the laity. It seems hardly necessary to point out that scientific evidence as a basis for the claims is lacking, particularly in the light of the fact that such vaguely defined conditions as "bleeding gums" and "mouth sores" may be related to extra-oral conditions.

Apparently, the distributor of the product relies upon "sworn affidavits of doctors and dentists" as proof for the unrestrained claims and "scare" advertising presented on behalf of Py-Ro. Aside from the fact that testimonials are usually worthless as evidence, it should be noted that there may be a vast difference in results obtained from the use of a preparation in professional hands and those obtained by lay individuals. Moreover, it is not clear how the untrained layman is to know whether he is suffering from "trench mouth" or from "pyorrhea" or from both. Evidently, it has not occurred to the purveyor of Py-Ro that diagnosis is the first and often the most important step in the treatment of disease. He has also completely disregarded the influence of the state of general health on oral conditions.

In replying to the Council's request for information on Py-Ro, the firm stated composition of Py-Ro as follows:

"PY-RO is a modified Dakins solution containing 0.1% methenamine, 0.4% chorthymol, and yielding 0.65% available chlorine."

The firm offered to provide samples of Py-Ro to be used by the Council in the clinical evaluation of the product. It has, however, failed to present scientific evidence as to the usefulness of Py-Ro.

A consideration of the product, Py-Ro, from the standpoint of composition and nomenclature is of interest and importance to the profession and the public.

Py-Ro is described as a stable modified Dakin's solution on the package label. The active ingredients listed on the package label are 1.5 per cent sodium hypochlorite, 0.05 per cent chorthymol (sic) and 0.05 per cent oil of peppermint. As far as the Council is aware, there is no evidence to indicate that chlorothymol and oil of peppermint in these concentrations is of any practical value under the conditions of use. In the Council's opinion, there is no scientific or other justification for attaching a non-informative and therapeutically suggestive name to a modified Dakin's solution containing such additional unessential and irrational ingredients.

Modified Dakin's solution, which is a synonym for liquor sodii hypochloritis dilutus, is described in the U.S.P. XI. Modified Dakin's solution does not contain either chlorothymol or oil of peppermint. Therefore, the use of the designation Modified Dakin's Solution, even though this is preceded by the words "a stable," is unwarranted and misleading. Moreover, the Council entertains doubts as to the claimed stability of the product Py-Ro. It is admitted that approximately two years is a long period for a product of this class to maintain its original concentration of oxidizing substances. It will be noted, however, that the samples tested by the Bureau of Chemistry after this time interval were entirely lacking in sodium hypochlorite. In the absence of more convincing evidence than this, the Council is unable to accept the claim that Py-Ro is "A stable Modified Dakin's Solution." In the directions for the preparation of a modified Dakin's solution in the U.S.P. XI, provisions are made for the preparation of a mixture which is just about alkaline to phenolphthalein. This degree of alkalinity would correspond to a pH value of about 8.4.

As can be seen from the chemist's

report, none of the samples of Py-Ro tested even approaches this requirement. Dentists and physicians who have used modified Dakin's solution will understand the importance of this requirement. Excessive alkalinity in modified Dakin's solution causes irritation. Possibly the following, which appears on the package label of Py-Ro, is related to this fact:

Directions: No. 1. Using cotton saturated with PY-RO, rub your gums for five minutes at a time, twice a day. Time this with a clock. Once a day soak fair sized pieces of cotton with PY-RO and place on each side of affected parts of gums for ten minutes. If too strong for your condition, see directions No. 2.

The usefulness of liquor sodii hypochloritis dilutus, modified Dakin's solution, is so generally recognized, especially in surgery, that discussion of this point is unnecessary. It should be carefully noted, however, that the solution is an adjunct to a special surgical technic. The results obtained from use of the solution depend in large measure upon adherence to the details of the technic. As far as the Council is aware, modified Dakin's solution has not been used extensively in dental practice for the treatment of periodontoclasia or Vincent's infection. Certainly it has not been shown that either modified Dakin's solution or Py-Ro, in the hands of the laity, is of value in the treatment and prevention of "pyorrhea" and "trench mouth."

REPORT OF THE A.D.A. BUREAU OF CHEMISTRY

(a) Three bottles of Py-Ro, submitted by Cable Products, Hamilton Grange Station, New York, N. Y., and received January 10, 1939, were presented for examination.

The contents of two bottles were bulked for analysis. Each bottle contained about 175 cc. of a faintly yellow liquid. The liquid contained a fine sediment and had an odor resembling that of chloroform.

Qualitative examination indicated the presence of chlorides. Hypochlorite was not found. Calcium was not found.

Quantitative analysis yielded the following:

pH	9.4
Per cent available chlorine	None
Per cent sulfated ash	2.83
Density (24°)	1.017

(b) Three bottles of Py-Ro (price $2 each) purchased on the open market were submitted to examination immediately upon receipt.

The package label bore, among other things, the following:

PY-RO 6 fluid ounces. A Stable Modified Dakin's Solution 1.5% sodium hypochlorite, 0.05 chorthymol [sic] 0.05% oil of peppermint.

Note: Let all members of your family use Py-Ro as a daily mouth wash to keep gums in healthy condition, using one spoonful of Py-Ro in a half glass of water.

Cable Products.

Qualitative examination indicated the presence of chlorine, chlorides and hypochlorites.

Quantitative examination yielded the following:

pH	10.35
Density (21° C.)	1.0175
Per cent sulfated ash	3.00
Per cent available chlorine	1.43
Per cent sodium hypochlorite (calculated)	1.50

(End of chemist's report)

Py-Ro is essentially a dilute solution of sodium hypochlorite, containing additional irrational ingredients. It is promoted to the laity under a therapeutically misleading name and with unwarranted claims. Py-Ro is therefore declared unacceptable because of conflict with Rules 2, 3, 4, 6, 8 and 10.

A copy of the rules that govern the Council in the consideration of articles will be sent on request.

HAROLD L. HANSEN, *Secretary.*

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Anesthetics—Local*

Monocaine Hydrochloride.—2-isobutyl amino ethyl para amino benzoate hydrochloride. $NH_2C_6H_4COOCH_2CH_2NHCH_2CH(CH_3)_2.HCl$. The base of monocaine hydrochloride differs from procaine base in that the former contains the monoisobutylamino group in the side chain in place of the diethylamino group.

ACTIONS AND USES: Monocaine hydrochloride is a local anesthetic acting like procaine hydrochloride when injected. Monocaine hydrochloride is somewhat more active as a surface anesthetic than is procaine hydrochloride.

Monocaine hydrochloride is said to be about 1.6 times as toxic as procaine hydrochloride when injected intravenously into guinea-pigs. As it is a more active anesthetic than procaine hydrochloride, in a 1 per cent solution with epinephrine it compares favorably with a 2 per cent solution of procaine hydrochloride containing epinephrine. One Council consultant found no appreciable difference between monocaine hydrochloride 1 per cent with epinephrine 1:75,000, and procaine hydrochloride 2 per cent with epinephrine 1:50,000 in respect to duration of anesthesia, postoperative disturbances and side effects. Another consultant reported that, on the average, anesthesia with monocaine hydrochloride lasts somewhat longer, but that postoperative disturbances and side effects are somewhat more frequent.

DOSAGE.—For injection anesthesia, monocaine hydrochloride is used in 1 per cent concentration with epinephrine 1:75,000.

Manufactured by Novocol Chemical Mfg. Co., Inc., Brooklyn, N. Y. U. S. Patent No. 2,139,818 (December 13, 1938). Trademark No. 353,563 (January 11, 1938).

Monocaine hydrochloride occurs as an odorless white fine crystalline powder that melts between 192 and 194° C. It is stable in air. Monocaine hydrochloride has a bitter taste and produces anesthesia when applied to the tongue. It is soluble in water to the extent of 3 gm. per hundred cubic centimeters and in 95 per cent ethyl alcohol to the extent of 1 gm. per hundred cubic centimeters at 25° C. Monocaine hydrochloride is insoluble in acetone, chloroform and benzene.

From aqueous solutions of monocaine hydrochloride, the free base is precipitated as an oil by addition of alkali hydroxides and carbonates. The solution is, however, compatible with sodium bicarbonate solutions.

To one-tenth gram of monocaine hydrochloride in 5 cc. of water, add 2 drops of concentrated sulfuric acid, then 1 cc. of a saturated solution of sodium nitrite and heat to 50° C. A yellow oily nitroso compound separates from the solution. This test distinguishes monocaine hydrochloride from procaine hydrochloride, butyn sulfate, cocaine hydrochloride and other local anesthetics that do not bear the secondary amino-alcohol configuration of monocaine hydrochloride.

Dissolve one-tenth gram of monocaine hydrochloride in 10 cc. of distilled water and heat to 35° C. Saturate the solution with hydrogen sulfide. The test for heavy metals is negative.

Dissolve one-tenth gram of monocaine hydrochloride in 1 cc. of concentrated sulfuric acid. The solution is color-

*A.D.R. Ed. 6, p. 38.

less. The ash from five-tenths gram of monocaine hydrochloride is negligible.

Monocaine hydrochloride in aqueous solution may be determined quantitatively by the A.O.A.C. method for quantitative determination of procaine hydrochloride.

Monocaine HCl 1%, Epinephrine 1:75,000: Each cubic centimeter is stated to contain monocaine HCl 0.01 gm.; epinephrine, 0.000013 gm.; sodium bisulfite, 0.002 gm.; sodium chloride, 0.0065 gm., and distilled water. Marketed in anestubes (midget, small, large and 5 cc.), novampuls (2.2 cc., 5 cc.), ampuls (1.5 cc., 2 cc., 2.5 cc., 3 cc. and 5 cc.) and bottles (1 ounce, 2 ounce and 4 ounce).

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information regarding the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

COUNCIL ON DENTAL EDUCATION

DENTISTRY AS A PROFESSIONAL CAREER

THE Council on Dental Education has carried out a plan announced several months ago by the publication of a brochure on "Dentistry as a Professional Career." This brochure is designed especially for the use of guidance officers in high schools and colleges, for parents who are concerned about the professional careers of their children and for young people who seek information on their own account about opportunities in dentistry. It will be distributed to deans of dental schools, to secretaries of state dental examining boards, to the Board of Trustees and to members of the House of Delegates of the American Dental Association, to dental journals, to college presidents and liberal arts deans and to guidance officers throughout the country. The brochure will be furnished in quantity to dental schools and other educational organizations at cost.

The purpose of the Council is not to act as a recruiting agency for the dental schools, but to present the case for dentistry as a professional opportunity in order to help young people who are interested to decide for themselves whether they shall seek a career in this field. To this end, the historical background of dentistry is presented, the evolutionary process that has taken place in dental education is discussed and the present predental and professional requirements are outlined in full. Information is also afforded about the cost of a dental education, the means of securing a license, the types of practice and the rewards of the calling, both material and professional. Other sections deal with opportunities in the Army, the Navy and the Public Health Service and the organization and literature of the profession. Auxiliary fields of service, such as those of the dental hygienist, the dental office assistant and the dental technician, are also presented.

The concluding section, addressed directly to young people who are considering the possibility of preparing themselves for the dental profession, is entitled "The Present Emergency" and reads as follows:

The high school pupil looking forward to a professional life or the college student ready to enter a professional school, and who is inclined toward dentistry, may well take note of the implications of the present emergency. What are the prospects which face him? Dental education, dental literature and dental professional organizations

in this country have their roots in a century of gradual development and honorable accomplishment. No one now engages in dental study without at least two years of liberal arts training. Half of the students now enrolled in the dental schools have more than two years of preliminary training, and one-fourth of them hold a bachelor's degree. The professional course of study, closely related to medicine, soon to be administered entirely by universities, is everywhere at least four academic years in length and everywhere emphasizes the biologic approach and preventive measures, as well as the highly developed restorative processes. The spirit of inquiry everywhere permeates dental teaching, and research into the causes of dental disease is extended every year. Graduate and postgraduate courses of study are on the increase and thousands of dentists resort to clinics and group conferences and studies to improve themselves in service. An extraordinarily large percentage of active practicing dentists hold membership in the American Dental Association and subscribe faithfully to a remarkable degree to the ideals and tenets of the profession as expressed in its Code of Ethics. In short, it may be said that the prospective dental student contemplates entry into an honorable, learned profession.

What about the need of dentistry from the standpoint of the entire population? Hundreds of studies have shown the incidence of dental caries among school children to be enormous, decayed teeth being by far the most common defect among them. Dental defects and dental diseases are found to a marked degree among college and university students, who are, in a measure, a select group. Few adults escape dental defects or disease. The wide-spread prevalence of dental ills is shown by the fact that one out of every five men now being rejected by the Selective Service System for physical reasons is rejected because of dental defects. These widely known conditions, coupled with the fact that not more than 22 per cent of our entire population of 130,000,000 people receive dental care in a given year, furnish the prospective dental student with ample proof that there is work to be done.

How well do we keep pace with the dental ills of our entire population in the number of new dentists who enter the profession every year? For more than a hundred years, the ratio of dentists to population steadily increased. In 1810, we had approximately one dentist to every 144,800 people. In 1930, we had one dentist to every 1,728 people. A marked change has come about during the last decade. For the first time in 130 years, the ratio of dentists to population has decreased. It is estimated that we now have one dentist to every 1,830 people. This trend becomes evident at the very time when the administration of the Selective Service System throws the spotlight upon the wide prevalence of dental defects and dental disease. Another situation coincides with these facts. The entire graduating class from all the dental schools in the United States in 1941 was the smallest in the last twenty years, and, with two exceptions, the smallest in the last forty-four years. The graduates in 1941 numbered about 1,550. It has been estimated that it would take at least 2,250 graduates each year to meet the loss by death and retirement and the expected increase in population. In other words, to maintain the existing ratio of dentists to population, we should have at least 700 more graduates. This estimate, it should be noted, does not take into account the clear evidence of the necessity of increasing the ratio of dentists to population, not only to meet the needs of our armed forces in the present emergency, but also to provide the dental service which an awakened interest in the civilian population now demands. The prospective dental student faces a profession which is not overcrowded.

Beyond the material rewards which a career in dentistry offers, what are the opportunities for a life of service to one's fellows? This question is asked by all prospective dental students possessed of inherent professional instincts. The dental art, especially in its reparative and restorative processes, is more advanced in America than anywhere else in the world. The new dentistry, however, goes far beyond mere excellence in mechanical performance. In our time, it has become universally recognized that the ills of the oral cavity are closely related to the other ills of the human

body. Accordingly, dental education and progressive dental practice have come to be based upon biologic fact. Fine craftsmanship is valued as highly as ever, but the exercise of a clear knowledge of basic systemic conditions now precedes any physical process in the mouth. Thus the emphasis in the practice of dentistry has been changed from the extraction of teeth and the mechanical restoration of lost teeth to the prevention of dental ills. Dentistry continues to be an art, but it is now an art based upon fundamental scientific knowledge. Inquiry into the yet elusive causes of dental caries calls for the highest type of investigation and scientific research. The contribution which dentistry is making and can make in the future to the promotion of public health and well-being is unmeasured. Fine avenues for service to humankind await the modernly educated dentist.

It seems quite certain that the knowledge we now possess about the causes of dental disease and the repair of dental defects will gradually be carried by an enlightened society to an ever increasing percentage of our entire population. It seems equally certain that the borders of our knowledge will be extended. The challenge to young people in the prospect is worthy of serious consideration. The Council on Dental Education, responsible for this effort to present a truthful picture of dentistry as a way of life, would not urge that dentistry offers a soft or easy way to carve out a career. Quite the contrary is true. It calls for rugged health, sound education, deft fingers, long hard hours and life-long devotion to a cause. That the durable satisfactions of life are to be found in it is evidenced by the thousands who have made their way in it in the past and who have won the confidence and appreciation of their fellow men.

EDUCATION FOR FAMILY LIFE

"EDUCATION FOR FAMILY LIFE" is the latest yearbook of the American Association of School Administrators, published February 1941.

It evaluates the real worth of the family in terms of the needs of the individual as well as the needs of society, thus giving concrete expression to the oft-quoted phrase, "The family is the bedrock of society."

It points out that serious attention should be given to the effect upon families of social and economic changes, race suicide and broken homes.

It challenges both school and home to greater endeavor in helping husbands and wives, fathers and mothers, boys and girls as they strive to make the American home realize its fullest possibilities.

It is a volume which should be in the library of every parent or teacher who has the happy task of inducting children or youth into life.

It contains a list of organizations with materials and services of use in education for family life, including the services of the American Dental Association.

It sells for $2 a copy.

BUREAU OF PUBLIC RELATIONS

CANCER OF THE MOUTH

THE CAUSES AND DIAGNOSIS OF INTRA-ORAL CANCER*

CANCER of the mouth is one of the most easily preventable forms of cancer. The causes of this form of cancer are well known to the medical and the dental profession, and the tissues of the mouth are accessible for observation of any abnormal conditions; but, in spite of these favorable aspects of the lesion, intra-oral cancer continues to present a definite problem in early diagnosis and treatment. The United States Report on Vital Statistics for 1939 indicated that 5,012 deaths were due to intra-oral cancer.

Intra-oral cancers differ markedly in symptoms and indications for treatment, and few important general statements can be made concerning them. The significant facts relate to the individual forms of the disease.

Uncleanliness of the mouth and chronic infection of the gums and teeth seem to be definitely associated with the majority of intra-oral cancers, and both of these conditions can be corrected. Since dental decay and pyorrhea and the wearing of imperfect dentures account for much intra-oral sepsis, the responsibility for preventing and detecting intra-oral cancer falls chiefly upon the dental profession. On the other hand, buccal and pharyngeal hygiene is a personal duty of the patient, and frequently the cooperation of patient, dentist and physician is necessary for early diagnosis and in order to institute adequate treatment of intra-oral cancer.

Since cancer of the lip is so conspicuous and obtrusive, it seems strange that it is ever permitted to develop. Its causes are numerous and varied, but chronic irritation from protruding teeth, sunburn, the use of tobacco and mechanical irritation from pipes or other objects habitually held in the mouth are common causes. Irritation resulting from the practice of carrying nails and pins in the mouth; wounds from hot steel splinters or hot tar or single puncture wounds, and cuts by a razor have all been more or less directly followed by cancer of the lip.

The offending tooth is usually decayed, broken and ragged. It may merely be slightly out of line or slightly protruding, but it impinges on the lip, and thickening of the epithelial layer results at the point of impact; or its presence may repeatedly result in slight lacerations that are slow to heal. Occasionally, burns from heat, chemicals and, particularly, sunlight lead to cancer of the lips. If the patient is a tobacco user, an additional source of irritation is provided. Since the smoking habit has become widely adopted by women, cancer of the lip in the female sex seems to be increasing.

In its early stages, cancer of the lip varies in appearance. The commonest form is a localized pearly thickening, elevation or warty outgrowth. Often, the disease seems to begin in a chronic fissure or superficial sore, which does not heal, but develops the hardened edges and undergoes the slow erosion of primary ulcerating cancer. A firm, hardened area of infiltration about the edges of a sore on the lip is always to be suspected.

The third form of cancer arises in

*Prepared and published by the Committee on Public Health and Education of the American Dental Association and the American Society for the Control of Cancer.

lips that are the seat of a scaling, moist area of inflammation. In these cases, the cancer is spread over a wide area and the lip may continue to be soft without any evidence of thickening. The treatment of any of these suspicious lesions of the lip by caustics, especially by nitrate of silver, is unwise. They should be referred to a competent physician.

Cancer of the tongue, floor of the mouth or cheek is associated with the presence of bad teeth, the use of tobacco and syphilis. In the average case of oral cancer, the mouth is very unclean. A decayed, broken or ragged tooth, or one that is merely out of line, but otherwise smooth, is often found exactly opposite the cancerous area. Sharp-edged teeth should be ground down or extracted. Loose or ill-fitting plates frequently rub and erode the adjacent mucous membrane and, after months or years, a warty eroded cancer may develop.

Many people think that when the teeth are extracted and false teeth are inserted, the mouth can be neglected, no more dental attention being necessary. Those who wear dentures should be impressed with the fact that the jaws and gums change in size and shape, and that, in most cases, refitted or new dentures are necessary from time to time to insure a comfortable fit and prevent a harmful effect.

It is also important to restore all missing teeth, in order to eliminate any irritation to the adjacent tissues from suction or pressure created in the act of swallowing, speaking, etc., drawing or pressing the tissues into these spaces. Usually, the irritation that leads to cancer extends over a long period, but, in rare cases, a single injury or tongue bite fails to heal, and eventually cancer develops. Irritation from tobacco adds to the wounds produced by teeth. The use of tobacco often causes leukoplakia, or "smoker's patch," which presents numerous small areas of opacity, on the mucous membrane. These spots tend to become warty, thickened and eroded, and when they are pronounced, suspicion of cancer is justified. In such a case, it is generally wise to remove all decayed teeth and all dental plates, and to advise the patient not to use tobacco. The development of cancer in well-marked old leukoplakic spots is often quite rapid. These areas are particularly dangerous if on the cheek or the gingival border.

Syphilis, untreated or inadequately treated, is found to be present in a considerable percentage of cases of cancer of the tongue; but what its exact relation is to the cancer, it is difficult to determine. Syphilis causes diffuse hardening, scars and fissures and, occasionally, characteristic more or less regular markings on the tongue, giving it an irregular appearance. These lesions render the tongue more susceptible to the action of tobacco and to wounds and infections. In the syphilitic scars and fissures, leukoplakic spots form, hardening occurs and cancer develops, often in multiple foci over a wide area.

Infection plays a large part in the causation of intra-oral cancer. The infection arises in decayed teeth, tonsillar crypts, at the base of the tongue, in peridental areas and about fixed or movable dentures. In addition, acute infections are readily established in the chronically infected mouth. Bacteriologically, the mouth is the dirtiest cavity in the body, and the offending bacteria are of highly pathogenic types. The French have a proverb *La mort entre par la bouche*—"Death enters by the mouth."

That a great number of local and general infectious processes arise from mouth sepsis, rendering oral hygiene a major medical and dental problem, is well known. The relation of oral sepsis to cancer is evident in the resulting chronic inflammations, which are added to the effects of tobacco, to wounds and

to syphilitic erosions. Thus, every resource of the dentist that can be employed in oral sepsis tends to prevent cancer as well as many other lethal diseases. To review these resources, which fill a long chapter in dental therapeutics, is outside the scope of this article, but the pathologist would emphasize that cleaning the mouth by chemical agents is an impossibility, and that the dentist and physician must rely upon mechanical and physical measures. The daily use of a mild cleansing dentifrice, with moderate force in brushing the teeth, is particularly recommended as an aid in keeping the mouth clean. The daily routine use of astringent mouthwashes should be discouraged. The constant effect of astringents on the tissues is surely an unnatural one and is to be classified as an irritating force. For this reason, routine use should not be made of mouthwashes that "sting" or "burn." The suds of a bland neutral soap, used as a mouthwash, and especially as a gargle, which can reach the base of the tongue, tonsils and pharynx, is the most effective, safest and most generally available cleansing agent for the mouth and for all accessible mucous membranes. Soap, an antiseptic of no mean power, mechanically removes food particles, on which bacteria grow; macerates and removes excessive epithelium; clears the coated tongue, and causes a secretion of mucus from thousands of mucous glands, which is Nature's method of protecting the mucous membrane. Periodic special cleaning of the teeth by the dentist is a valuable adjunct to home care.

Because in appearance early mouth cancer varies greatly, and the impression exists that cancer is easily recognized, the disease often escapes detection in its early stages.

The cancer is usually in an exposed area, but very often it is in pockets and sulci, where its detection is difficult, requiring thorough exploration by an expert. At the base of the tongue, behind the pillars of the throat, in tonsillar crypts, on the wall of the pharynx and along the floor of the mouth, especially at the frenum of the tongue, the disease commonly escapes notice. Deep between decayed teeth, cancer arises from the surface epithelium, reaching the surface only after excavating a cavity in the jaw. Certain dental tumors develop more deeply in the jaws, causing expansion of the body of the bone.

The lesion itself is generally first evidenced as a thickening of the epithelium, which is leukoplakic or pearly, and many lesions assume a definite warty character. Yet many mouth cancers are soft and much inflamed, eroding early, and bleeding painfully, suggesting simply infectious processes. A positive Wassermann reaction, leading to the assumption that the disease is syphilitic, causes much delay and costs many patients their lives. Mouth cancer is one of the fields in which biopsy is indispensable but is often neglected. A biopsy is an examination of a small piece of tissue under a microscope. By this means, the presence or absence of cancer can be definitely determined. Contrary to previously held theories, there is no danger of spreading cancer by removing a specimen of tissue.

In the floor of the mouth, tonsils and pharyngeal wall, the usual signs of cancer are unreliable. Here, detection of early stages of the disease is very difficult, since it may begin deep in the tissues and simulate simple enlargement of the tonsils or other lymphoid structures. Therefore, the dentist and physician should regard with suspicion any persistent chronic swelling or erosion in any part of the buccal or nasopharyngeal mucosa.

The Plummer-Vinson syndrome, a peculiar nutritional disorder affecting the mucous membrane of the oropharynx and esophagus, chiefly in women, is often followed by cancer. The mucous mem-

brane of the lips, mouth and tongue is bright red, and the patient complains of a smarting sensation. The tongue is atrophic, red and shiny. There may be superficial erosion. Swallowing is painful when the esophagus is involved. There is usually some anemia, which may be severe. The disease is associated with defective liver function and has been attributed to vitamin deficiency. Some cases improve under large doses of vitamin B or yeast, but the advanced stages of the disease are refractory.

Dentistry also shares the responsibility for prevention of cancer of the nose and sinuses, both in young persons and in adults, because the nasal and sinus infections that are mainly associated with these forms of cancer frequently arise from chronic mouth infections and disorders of the teeth.

Mouth breathing due to nasal obstruction can be another source of irritation. Normally, the structures of the mouth are continuously bathed with saliva, but, in the case of the mouth-breather, the soft tissues tend to become dry and hard at night, when less saliva is secreted. Thus, the tissues are allowed to assume an unnatural state, which should be regarded as harmful and should be corrected.

Particular attention should be drawn to the fact that cancer and other malignant tumors of the mouth, nose and pharynx in children or young adults is often overlooked because of the impression that cancer is a disease of adult life. No age is immune and, in recent years, it has appeared that cancer is increasing in frequency, and certainly in recognition, and perhaps in occurrence in young persons.

In addition to the common epithelial cancer of the mouth, there is a considerable variety of rare tumors that are often first encountered by the dentist. Mixed tumors of the salivary gland type appear on the hard and soft palate, cheeks and pharyngeal wall, forming slow growing, solid and generally protruding masses that show little tendency to ulcerate. Giant-cell tumors of the mandible may form after violent extraction of teeth, producing fungating masses resembling granulation tissue. Or these tumors may arise more deeply in the body of the bone and cause slowly progressive hard swellings. The x-ray picture may reveal certain characteristic changes in the jaw bones. It is for this reason that the x-rays have assumed such importance in the diagnosis of obscure changes in the jaws.

Lymphosarcoma of the tonsil is curable in the early stages, but fatal in advanced stages. It affects one tonsil as a rule, causing progressive and marked enlargement of the organ. The remaining pharyngeal mucosa is generally much congested and the entire pharyngeal ring of lymphoid tissue may be much enlarged. A single much enlarged tonsil always suggests possible lymphosarcoma.

It is important to learn what has happened in the case of patients who reach an incurable stage of intra-oral cancer. Study of a series of such cases reveals two main reasons for failure to control the disease:

First, the early stages of cancer of the mouth are not always recognized. The disease may begin in a small focus, which is unimpressive and painless, or it is mistaken for an innocent process, and efficient treatment is delayed; or unwise treatment, generally by caustics, may aggravate the disease.

Second, the progress of cancer in the soft vascular mucous membrane of the mouth or pharynx is often quite rapid, at times almost explosive. Within two or three weeks, a small carcinoma of the tongue may be transformed from a strictly localized lesion into an infiltrating and ulcerating process. Delay in determining the nature of a suspicious sore or wart, by biopsy or by evaluation of posi-

tive clinical data, permits many a small easily curable cancer to reach a stage that entails a serious therapeutic procedure or offers a poor prognosis with any treatment.

While most of these mistakes occur in circles where the order of intelligence is not high, not a few arise under the very best conditions, both patient and physician being alert.

If the mortality from intra-oral cancer is to be markedly reduced, every known cause of cancer of the mouth must be recognized and eradicated; and every suspicious swelling, erosion, wart and sore in the buccal or pharyngeal mucosa must be regarded as presenting an emergency, calling for immediate, and positive diagnosis by a qualified expert.

AMERICAN DENTAL ASSOCIATION,
212 E. Superior St., Chicago, Ill.
AMERICAN SOCIETY FOR THE
CONTROL OF CANCER, INC.,
350 Madison Ave., New York, N. Y.

MOUTH HEALTH IN THE MAGAZINES

THE Dental Information Bureau of Greater New York calls our attention to Dorothy Lester's excellent article "True or False" in the August issue of *The Ladies Home Journal.*

Miss Lester, in cooperation with the Dental Information Bureau, describes for the laity the advances made in prosthetic appliances and emphasizes the necessity for prompt replacement of lost teeth and for close cooperation between patient and dentist.

"You cannot," writes Miss Lester, "go into a dental office looking like the witch of Endor and come out a Hedy Lamarr. But you can lose all your teeth at a time when you look forty-five—and are forty—and wind up looking in the early thirties." Dentures, she observes, provide the best way to keep looking young while growing old.

Miss Lester's timely article reminds us that several other magazines have attacked the dental problem within recent months.

The June issue of *Health* carries the second article* by Edmund M. Johnston explaining the modern method of caring for dental cripples. Dr. Johnston delves deeper into the childhood history of "Buck" Jones, "Horseface" Morgan, and "Bulldog" Mason for the benefit of today's parents.

Certainly after reading this article, mothers will look twice and have their dentist look twice at their children's teeth.

Incidentally, from the standpoint of consumer education the article "It's the Toothbrush, Not What You Put On It" in the May *Consumers' Digest* is just about tops. It's unfortunate that it does not reach more of the public. Quoting Drs. Gordon and Leech, the article states, "A tooth paste or powder can be considered as nothing more than an aid to the tooth brush in cleaning the surfaces and chalk and water will more likely do what expensive tooth pastes and powders might do. The brush and the manner of brushing, not the dentifrice, are the important thing." The article gives the American Dental Association Council on Dental Therapeutics credit for helping to clean up the tooth cleaners.

June's *Health Culture Magazine* permits Alice Chase to expound some of the latest theories regarding "Your Daily Food and Your Teeth," while the spring number of *Canadian Health Magazine* carries Charles H. M. Williams' article on the same subject, entitled "Eating Your Way to Health."

*First article mentioned on page 991, THE JOURNAL, June 1941.

The relationship between diet and dental health is getting its share of attention these days and, undoubtedly, when the newly formed national and state nutritional committees get into full swing, this subject will receive even more attention. Jessie Jones, R.N., writing in the June *Pure Milk Journal* of her experiences in Christian County, Illinois, says, "The way to tell whether a community is caring for its children's teeth is to look around and see the underweight children, the unhealthy looking children and those with misshapen jaws. Then we realize that this subject needs a lot of work."

April's *Health and Physical Education Magazine* carried "Are We Teaching Facts About Dental Health?" by Netta W. Wilson, educational assistant, Minnesota Department of Health. Miss Wilson coldly and calmly takes apart some of the leading and misleading dental health literature, and asks that it be reassembled in proper form for future use. A very good article because it reminds us that much of the advice given the public regarding the care of the teeth is founded more on fancy than on fact.

The June issue of the *American Journal of Public Health* carried Nathan Sinai's article "Where Is Dentistry Going in Public Health?" Public health workers, and particularly public health dentists, will be interested in this article, which deals with a subject that should indeed be of vital interest to every dentist.

"The Dentist and Your Child," by J. H. Rossman, in the July issue of *Health Magazine,* deals exclusively with preventive dental care. It should be on every dentist's waiting room table.

As might be expected, the prevalence of dental disease as dramatically exposed by the physical examinations of National Defense broke into magazine company recently. "The Teeth of the Recruit," an editorial on this subject, appeared in June *Hygeia.* S. R. Winters introduced his article "By the Skin of Their Teeth" in July *Hygeia* by quoting dental statistics from Selective Service.

Public Health Nursing, the official Journal of the National Organization of Public Health Nurses, published a series of seven dental health educational articles during the past winter, the last three of which appeared since the first of the year. These were prepared by members of the Dental Health Education Committee of the American Dental Association especially for the use of public health nurses.

"Irregularities of the Teeth" by Thomas A. Gardner appeared in the January issue. Doctor Gardner fortifies the nurse with answers to the following questions so often asked by mothers: "What causes crooked teeth?"; "Can this tooth be straightened?"; "How long will it take?" and "Will the tooth be damaged?" The important factor in a successful and economical school health program were discussed in the article entitled "School Programs for Dental Health" by L. W. Morrey in the March issue, while "Oral Diseases" by Howard C. Miller in April furnished the nurses with information regarding the more common pathologic conditions of the mouth.

Several other recent articles come to mind, but lack of space compels us to defer a report on them until next month. However, a casual browsing through the corner magazine stand indicates that magazine editors seem to be taking a keener interest in dental health and in passing their interest on to their subscribers.

ACCIDENTS OCCURRING IN HIGH SCHOOL ATHLETICS WITH SPECIAL REFERENCE TO DENTAL INJURIES

By LEON R. KRAMER,* D.D.S., M.P.H., Topeka, Kan.

OF the 11,500 high school students enrolled in the Athletic Accident Benefit Plan†, according to the report for the year 1939-1940, 691 sustained injuries requiring the services of physicians and dentists for treatment. Of the 691 accidents, 184, or 27 per cent, were dental injuries.

INJURY	Football	Basketball	Track	Wrestling	Baseball	Softball	Physical Education	Tennis	Swimming	Total This Year
Fractured pelvis			1							1
Fractured bone in hip										
Both bones of leg fractured between ankle and knee	5	2								7
Both bones of arm fractured between wrist and elbow	7	2								9
Leg fractured above knee	2									2
Arm fractured above elbow	8		2							10
Either bone of leg fractured between ankle and knee	22	3	1	1	2	1				30
Either bone of arm fractured between wrist and elbow	12	4				1	1			18
Cerebral hemorrhage				1						1
Fractured collar bone	25									25
Fractured jaw	1									1
Fractured vertebra	1									1
Clavicular separation	4									4
Fractured scapula	2									2
Fractured cheek bone	1									1
Fractured nose	39	6								45
Fractured bone in hand	22	2				1	1			26
Fractured bone in foot	2	4								6
Fractured rib	39	2								41
Dislocated ankle										
Dislocated knee	6	2								8
Dislocated shoulder	10	1								11
Dislocated elbow or wrist	9	1		1						11
Severe sprain and torn ligaments	83	23	5	3			1	1		116
Suspected fracture (x-ray negative)	101	17	8	1	4					131
Chipping of tooth	29	4								33
Broken dental facing	4	6								10
Filling knocked out	6	2								8
Loss of tooth, replaced by bridgework	21	3								24
Broken tooth	81	19		2	1	1				104
Not on schedule, approved by board of control	3	2								5
Total this year	545	105	17	9	7	4	3	1		691

These figures indicate that the chance of being injured in high school sports

*Director, Division of Dental Hygiene, Kansas State Board of Health.

†Summary of Accidents per Sport under Benefit Plan. Kansas High School Activities Journal, September 1940, p. 2.

is about 1 in 17. The chance of receiving dental injuries is about 1 in 60.

Football and basketball account for 97.8 per cent of dental injuries. Of injuries acquired in football, 26 per cent are dental accidents; in basketball, 34 per cent are injuries to the teeth.

Of the amount, $7,532.47, paid to physicians and dentists for the treatment of injuries, $5,992.22 was paid out for injuries received in playing football, and $1,059.75 was paid out for injuries received in playing basketball. Football and basketball accidents accounted for about 93 per cent of all monies spent for treatment of injuries. Football contributes four times as many accidents as all other sports combined and five times as many as basketball.

According to the report, the most expensive injuries per unit cost were those received while wrestling and playing softball and in physical education.

The distribution of injuries by type of sport is shown in the accompanying table.

CALIFORNIA PHYSICIANS' SERVICE

THE report of the first year and a half of operation of the California Physicians' Service ended December 31, 1940 shows that growth in membership has been slower than anticipated. The service has to be sold, which requires time and effort. The contracts are made with groups, a process which often requires long negotiations. At the time the report was issued the membership was somewhat in excess of twenty thousand. This slow growth is not considered wholly undesirable. Many problems have been uncovered in the course of operation, and experiment is less costly with a small than with a large membership. The growth of professional membership has been fairly steady and amounted to 5,308 physicians who had accepted the conditions of practice under the plan at the time the report was issued.—*J.A.M.A.*, May 17, 1941.

BILLS BARRING PROFESSIONS TO ALIENS VETOED

GOVERNOR Dwight Green vetoed all of the Dale bills which would have prohibited aliens from practicing medicine, dentistry, law and nine other professions and trades in Illinois. In addition to his own strong feelings against this type of legislation, the governor had the backing of an opinion from Attorney General George F. Barrett that all of the measures were unconstitutional except the one barring aliens from practicing law.

Barrett based his opinion on the fourteenth amendment to the United States constitution, which is repeated in essence, in the Illinois state constitution and prohibits discrimination against aliens so as to deprive them as a class of the right to engage in lawful pursuit, upon the same terms and conditions as citizens.

Representative S. O. Dale (R. Fairfield) introduced the series at the request of American Legion officials and physicians and dentists. They were passed by votes of 107 to 6 in the house and 35 to 11 in the senate.

COMMITTEE ON LEGISLATION

DENTAL SERVICES AS MEDICAL OR SURGICAL WITHIN WORKMEN'S COMPENSATION STATUTES

By LESLIE CHILDS, Indianapolis, Ind.

IN view of the wide enactment of Workmen's Compensation and similar statutes, the question of whether dental services constitute medical or surgical treatment within their terms becomes of interest to the dental profession. The question has been litigated in a number of cases and, generally speaking, has been answered in the affirmative, where the circumstances of the injury have met the statutory requirements in respect to arising out of and in the course of the employment. For example, let us take Belmont vs. Paramount Publix Corporation *et al.*, 283 N.Y.S. 322. Here, the claimant was a dancer. Her employer was engaged in operating a theater where she was employed professionally. As she walked off stage, the claimant caught her foot in a cable with the result that a lamp fell on her head.

As a result of the accident, the claimant lost a tooth, which was replaced by an artificial one anchored by two gold inlays. On the facts, the Industrial Board awarded the claimant $100, holding the injury was covered by the New York Workmen's Compensation Law. The employer and its insurance carrier appealed, and the court in affirming the award, said in part:

> The replacement of a tooth is "such medical, surgical or other . . . treatment . . . and apparatus . . . as the nature of the injury . . . may require" as authorized by section 13 of the Workmen s Compensation Law. Award unanimously affirmed with costs to the state industrial board.

A like conclusion was reached in Odom vs. Atlantic Oil Producing Co., 162 La.556, 110 So. 754. Here, the plaintiff suffered injuries, among them the loss of three lower teeth, which were replaced. On these facts, the lower court, in awarding the plaintiff compensation under the Louisiana law, did not take into account the loss of the teeth. On appeal, the higher court, in holding that an allowance should have been made therefor, reasoned:

> The reason why the [lower court] did not allow compensation . . . for the loss of the teeth does not clearly appear. However, it is likely that it did not because it considered that there was no specific demand for compensation . . . or because the teeth have been replaced by false ones, and, in its opinion, no serious permanent disfigurement or serious permanent impairment of a physical function has resulted. . . .
>
> In our opinion, the loss of three lower front teeth is a serious permanent disfigurement. Moreover, such a loss . . . is a serious permanent impairment of a physical function, since it interferes with the one sustaining the loss in eating. The fact that the teeth may be, and in the instant case were, replaced does not wholly remove the disfigurement or the impairment, or the seriousness of either, though it lessens it. . . . In our view, the plaintiff should be allowed compensation for this injury.

So much for the foregoing. However, in rendering services in situations of this kind, with the expectation of holding an employer liable, a dentist should have some care in respect to coming within the law. For while the services rendered may constitute "medical" or "surgical" treatment within a compensation law, the liability of an employer therefor may

not follow. This may turn upon the circumstances of the injury and its treatment, in the light of the terms of the statute involved. For illustration, let us examine Picanso's Case, 281 Mass. 476, 183 N.E. 756.

EMPLOYE SUFFERS INJURY

Here, an employe of a silk mill had one tooth broken and another loosened when she was struck in the face by a flying shuttle. This accident occurred July 11. In August, more than two weeks thereafter, the employe called at the office of the claimant, a dentist, for treatment of her injury.

The claimant, evidently relying on the employer for payment under the Workmen's Compensation Act, took an x-ray picture and extracted the two injured teeth and replaced them with artificial teeth attached to a bridge. The total charge was $65, for which the claimant filed his claim with the Industrial Accident Board. The latter allowed the claim. The employer and its insurance carrier appealed on the ground that the services rendered did not fall within the time limit of the statute. The latter, in part, provided for medical and surgical treatment as follows:

> During the first two weeks after the injury, and if the employe is not immediately incapacitated thereby from earning full wages, then from the time of such incapacity, and in unusual cases, or cases requiring specialized or surgical treatment, in the discretion of the department, for a longer period, the insurer shall furnish adequate and reasonable medical and hospital services. . . .

Here, as has been noted, the employe suffered her injury July 11, but did not apply to the claimant, a dentist, for treatment until August, more than two weeks thereafter. So too, it was conceded that she "lost no time on account of the accident." On the foregoing facts, the court, in denying the claimant any recovery for services rendered, said:

> It is manifest that it was the intention of the legislature that the obligation to provide medical or surgical attendance as an absolute duty is confined to the two weeks following the injury, or, if the employe is not immediately incapacitated, during the first two weeks after such incapacity. . . .
>
> It follows that as the employe received no medical or surgical treatment during the first two weeks after the injury, and as she was not incapacitated from work and lost no time on account of the accident, there is no provision in the statute for the payment for such treatment thereafter. . . . Decree [for the employer and its insurer] affirmed.

So too, in rendering professional services to injured employes in reliance for payment by the employers under Workmen's Compensation statutes, a dentist should look carefully to the provisions of the latter in respect to limitations on the amount an employer may be held for; for the reason that such statutes may contain limitations, and a dentist may be limited in his recovery to the amount so provided.

The importance of care here may be illustrated by a brief review of Brandon vs. Kentucky-Tennessee Light & Power Co., 173 Tenn. 258, 116 S.W. (2d) 1029. A medical case this, but since the holding is equally applicable to dental practitioners, it is included here. The facts were as follows.

The plaintiff, a physician and surgeon, was called in to treat one of the defendant's employes who had suffered injury in the course of his employment. A few days thereafter, the defendant's insurance carrier wrote the plaintiff acknowledging the latter's employment to treat the injured employe, requested a physician's report on the case and, in part, said:

> You will please understand that the case is to be dealt with according to the medical provisions of the Workmen's Compensation Act, with which you are no doubt familiar, and by which you should be governed.

At this point, it may be noted that, under the referred-to Workmen's Compensation Act, an employer's maximum

liability for doctor bills was limited to $100. The plaintiff rendered professional services to the injured employe of the value of $403. The defendant declined to pay more than $100, and the instant suit followed. The plaintiff was awarded judgment for the full amount of his claim in the lower courts. On appeal, the higher court, in reviewing the record and in reducing the amount said, among other things:

> The medical provisions of the Workmen's Compensation Act . . . include a provision that "the total liability of the employer under this section shall not exceed one hundred dollars; and an additional one hundred dollars for hospital expenses. . . ."
>
> The letter from the insurer was plain notice that the insurer was paying the doctor's bill, but that it did not assume liability beyond $100. The doctor [plaintiff] apparently acquiesced in this. He did not reply to the insurer's letter except by the report requested, which he made to the insurer. . . .
>
> . . . we think the courts below were in error in awarding recovery to [the plaintiff] for the full amount of his bill. He is entitled to judgment for $100, which will be entered here.

Clearly, on the facts and holdings of the foregoing decisions, dental services constitute medical or surgical treatment within the meaning of these terms as used in Workmen's Compensation statutes. And when such services are rendered an injured employe, in compliance with the statutory provisions, the dentist may enforce payment against the employer.

However, the burden of showing that the circumstances of the injury, as well as his rendition of services, fell within the provisions of the statute will rest upon the dentist. Consequently, in rendering professional services in situations of this kind, the dentist should have in mind, and stay within, the pertinent provisions of the Workmen's Compensation Statute involved, as a credit safeguard of the account.

LABORATORY ADVERTISING RESTRICTIONS UPHELD BY ILLINOIS SUPREME COURT

IN a decision rendered June 13, 1941, the Supreme Court of Illinois sustained the constitutionality of an amendment to the Illinois Dental Practice Act which prohibits dental laboratories from advertising directly to the public. This decision culminated a two-year battle between the owners of certain laboratories, who were arrested for violating the law and the Illinois enforcement authorities.

While their cases were pending in the county court, the defendants filed a bill for an injunction to prohibit the enforcement of the law on the ground that it was unconstitutional. It was upon the question of whether the injunction should be issued that the case was carried to the Supreme Court.

The attorneys for the laboratories have filed a petition for a rehearing of the case, but to date the court has not acted upon the request.

In its decision, the court upheld the right of the legislature to regulate the practice of dentistry because of its intimate relation to public health and welfare and reaffirmed its previous opinion authorizing the restriction of advertising by dentists. With respect to advertising by laboratories, the court said:

Appellants claim they have a constitutional right to advertise their business and sell their products to the public, subject only that the making of impressions and the fitting and adjustment of the plates shall be by a licensed dentist. It is obvious that if they were permitted to thus advertise their business, the practice of the profession of dentistry would, to a great degree, be subservient to the business of those engaged in the making of plates. It is well known that masses of the public do not comprehend or understand the skill that is necessary to the making of proper dentures and the proper charges to be made for such services. Such persons are often attracted by the advertisements of the quack and charlatan and seek his services. . . .

If the restrictions of which appellants complain were removed, it would permit licensed dentists receiving patients referred to them by the dental laboratories to do indirectly what other provisions of the act prohibit them from doing directly.

This is the first case involving the constitutionality of such restrictions, and it is gratifying that the courts continue to recognize the public health and welfare aspects of this type of legislation. Other states which have recently passed similar amendments covering this subject are Florida, Louisiana, Maine, Maryland, Michigan, New York, Ohio, Rhode Island and Wisconsin. The District of Columbia has also passed such an amendment.

DENTAL BILL SIGNED BY GOVERNOR

A BILL which makes it mandatory that the governor appoint members of the state dental examining board from a list submitted by the Washington State Dental Association was passed by the state legislature and has been signed by Governor Arthur Langlie of the State of Washington.

OHIO AMENDS DENTAL LAW

SEVERAL amendments to the Ohio Dental Practice Act were approved by the governor May 21. One of the major changes made is the insertion of a phrase which states that the construction, repair, reproduction, etc., of prosthetic appliances except upon the order or prescription of a licensed dentist constitutes the practice of dentistry.

The section also prohibits the advertisement of services in the construction or repair of prosthetic appliances to any one except licensed dentists.

Another addition to the law is a provision permitting the issuance of intern certificates to qualified persons holding hospital internships in the state. These certificates are for one year only and may be revoked by the board at any time.

The recent changes also permit the board to employ assistants, inspectors and investigators to aid the board in carrying out the purposes of the act.

THE HOUSTON MEETING

IN these summer days, preoccupation with vacations very properly comes to the foreground in discussing the Eighty-Third Annual Meeting of the American Dental Association in Houston, Texas, October 27 to 31.

The convention committees are working in high gear to have everything in order for the 8,000 dentists expected to attend and the convention program is already in the final stage of preparation.

But the flood of early reservations at this vacation time indicates that Houston's fame as a center of unusual opportunities for relaxation has influenced the thinking of many members of the profession, who view the convention as a grand chance for a "second vacation" this year.

And they are right! Certainly no convention site in recent years has had so much to offer in this regard.

Houston is known as a city of "culture and cut-uppery," where symphonies and rodeos are supported with equal enthusiasm; where night clubs hang out "standing room only" signs on Saturday nights and churches hold two Sunday morning services to accommodate the crowds.

Yes, Houston is the place where 10-gallon Stetsons and fancy boots aren't worn by drug store cowboys . . . where suntanned skin is really tanned by the sun . . . where famous eating places are known the world over for seafood, for tamales and for beef . . . where the flavor of the South and the zest of the West are combined and blended in food, and in living.

Houston is truly a port of the seven seas, grown from a log-cabin frontier town on a sleepy bayou to the nation's third largest shipping center and the largest city in Texas.

Tallest in America is the memorial shaft that rises from the site of the historic battle of San Jacinto. Nearby is the ship channel, which runs to the sea.

A friendly city with a romantic past; a bustling city alive to modern comforts—Houston is the proud metropolis of the Southwest and a gateway to Mexico, where we have been invited for post-convention tours.

This is the city which will be host to the American Dental Association's 1941 Annual Meeting. All sessions, together with the exhibits, 400 table clinics and the eight Scientific Sections, will be housed in the new $2,000,000 Sam Houston Coliseum. The Rice Hotel will be headquarters and 5,000 rooms are to be provided in more than thirty modern Houston hotels at regular year-round rates.

Most dentists are looking forward to October 27 as the start of a great sojourn with their professional colleagues in one of the most interesting cities of all the world.

Rice Hotel, Houston, Texas, Headquarters, Eighty-Third Annual Meeting of the American Dental Association, October 27-31, 1941.

American Dental Association

Houston, Texas October 27-31, 1941

HOTEL RESERVATIONS

To secure hotel accommodations for the 1941 Meeting, consult the rate list on the next page and fill out the blank below. Mail this immediately to the hotel of your first choice or to the Housing Committee, Room 344, Rice Hotel, Houston, Texas. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely to occupy the room at the time agreed upon, please write or wire the hotel, releasing the room, in order that it may be available for other members.

APPLICATION FOR HOTEL ACCOMMODATIONS

AMERICAN DENTAL ASSOCIATION

Houston, Texas October 27-31, 1941

HOTEL.....1st choice

HOTEL.....2nd choice

HOTEL.....3rd choice

Kindly reserve the following: ☐ Single room ☐ Double room ☐ Twin beds.

.....rooms with bath for.....persons $.....per room

.....rooms without bath for.....persons $.....per room

Arriving on October.....at.....a.m.....p.m.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL

NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make reservation requested, this application should be forwarded at once to the Housing Committee, Room 344, Rice Hotel, Houston, Texas.

SCHEDULE OF RATES

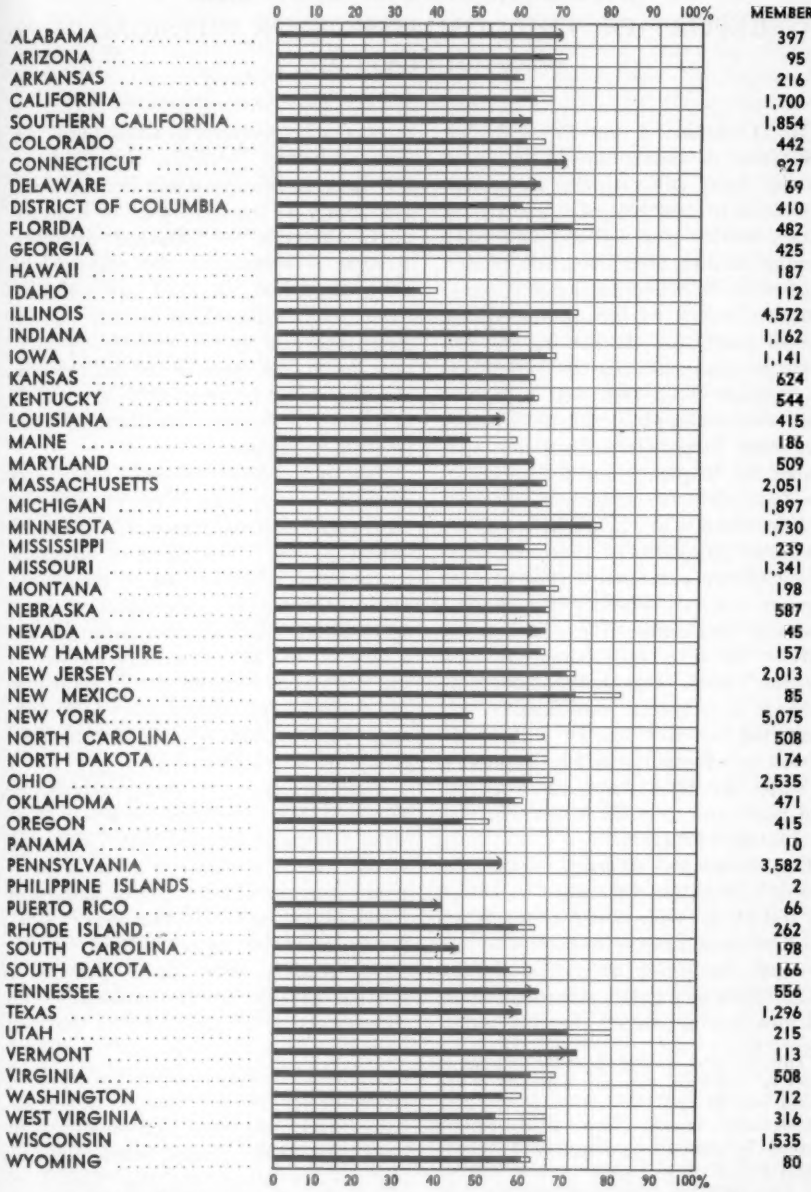
ALL ROOMS WITH BATH*

Hotels	Single	Double	Twin	Suites
AUDITORIUM, 701 Texas	$2.50–3–3.50	$3.50–4.50–5.50	$5	
BELMONT, 1308 Clay	$2	$3–3.50		
BRAZOS, 608 Preston	$2.50	$4	$4	
BRISTOL, 712 Travis	$2.50–3–3.50	$3.50–4–5	$4	
COTTON, Rusk and Fannin	$2–2.50–3	$3–3.50–4.50	$4	
DE GEORGE, 1418 Preston	$2	$3–3.50	$4.50–5.50	
FREDS HOTEL, 1006 Dallas	$1.50–2	$2–3	$2.50	
SAM HOUSTON, 1115 Prairie	$2.50–3–3.50	$4–5–6	$5–6	
HAMFORD APARTMENT, 919 Dallas	$1.50–2	$2–2.50		
HOUSTON CLUB, Commerce Building	$4–5–6	$6–7–8		
LAMAR, Main and Lamar	$3–4–5–6	$5–6–8–9	$5–7–8–9	$12–14–15–18–20–24
LAMAR ANNEX HOTEL, 916 McKinney	$2.50–3–4	$4–4.50–5–6	$5–6	
LEE, 1114 Polk	$2	$2.50–3	$3	
MACATEE, 519 Washington	$2–3–3.50	$3–4–5	$4–5	
BEN MILAM, 1521 Texas	$2.50–3–3.50	$3.50–4–4.50	$6	
MILBY, 902 Texas	$2–2.50–3	$3–3.50–4	$4–4.50–5	
OXFORD, 811 Lamar	$2	$3–4		
PARK, 610 Louisiana	$1.50	$2–2.50	$3	
WILLIAM PENN, 1423 Texas	$2–2.50–3–4	$3–3.50–4.50–5–5.50	$6	
PLAZA, 5020 Montrose	$3–3.50–4–5	$4.50–5–6–7	$6–7	$8–15
RHODES APARTMENT, 611 LaBranch	$2	$2.50–3		
RICE (Headquarters), Main and Texas	$3–4–4.50–5	$5–6–6.50–7–8	$6–7–8–9	$12–22–40
ROOSEVELT, 1111 Clay	$2	$2.50–3		
ROSSONIAN APARTMENT, 919 Fannin				$6–8
SAN JACINTO, 820 Main	$2.50–3–3.50–4	$4–4.50–5–5.50	$5.50–6–7–8	$10
STRATFORD, 414 Fannin	$2–2.50–3	$4.50–4–4.50	$4–4.50	
TENNISON, 801 Washington	$2	$3	$3.50	
TEXAS STATE, 720 Fannin	$3–4–5–6	$5–6–7–8	$6–7–8–9–10	$12–16–18–24
TRAVELERS, 114 Main	$1.50–2	$2–3		
WALEE, 1010 Caroline	$2	$2.50–3		
WARWICK, 5701 Main	$3.50–5	$3.50–5	$5–6	$6.50–7.50–9–11–18
WOODROW, 1412 Fannin	$2–2.50	$3–4–5		

*Rates on rooms without bath by request.

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF JUNE 30, 1941 AS COMPARED TO 1940 MEMBERSHIP



Percentage based on dental population figures supplied by the State Society Secretaries

1940 percentage. 1940 percentage.

NEWS ITEMS

REPORT OF THE COMMISSION ON PHYSICAL REHABILITATION*

THE Commission on Physical Rehabilitation is authoritatively informed that the Army will maintain its present high physical standards of eligibility for military service and will not undertake the rehabilitation after induction of men classified by Selective Service and Army induction boards as having remediable physical handicaps. In making the following recommendations, the commission has therefore been restricted to a program of voluntary physical rehabilitation.

In order to provide information concerning the frequency and the nature of remediable defects among men examined for Selective Service, it will be necessary to require physicians of Selective Service and Army induction boards to state in every instance whether the physical handicap responsible for classification I B or IV F is remediable, in their opinions. Such registrants should be grouped in a special classification and designated as I B-R and IV F-R. Without this information, it will be impossible for states and local communities to prepare plans and to estimate the cost of a rehabilitation program.

The diagnoses recorded upon the records of registrants classified in groups I B and IV F by physicians of the Selective Service and Army induction boards give little indication of the possibilities for complete or partial correction. There is a mistaken impression that the handicaps of all registrants in Class IV F are not correctible. Actually, registrants in I B have handicaps which restrict their availability to limited forms of military duty, although the physical disability in some is permanent and non-remediable. Registrants in IV F are suffering from major disabilities which render them incapable of performing any military duties, but some of the men in this category could be restored to group I B or even I A by the correction of their physical handicaps.

The special classification as I B-R and IV F-R will act as an incentive to voluntary correction of remediable physical handicaps. A comprehensive program for physical rehabilitation of the young men of the nation is important in order to maintain effective manpower for industry as well as for military service. It will also have an influence in retarding the development of disabilities of middle age, which account for an unemployable group in every community.

Experiments in voluntary rehabilitation have been proposed for a few local areas by the American Red Cross and several other agencies. A small experiment in a few selected urban and rural communities will not provide a satisfactory yardstick as to the cost for the entire country, nor can it provide a reliable answer to the problem. The commission is of the opinion that we must immediately lay the groundwork of comprehensive future plans for physical rehabilitation of our manpower by accumulating accurate information in every part of the United States concerning the frequency and the nature of remediable physical disabilities. It there-

*This report is published at the request of James A. Crabtree, executive secretary of the Health and Medical Committee of the Federal Security Agency. The Commission on Physical Rehabilitation was created by the Health and Medical Committee and this report was approved by that Committee July 2, 1941.

fore submits the following recommendation:

1. Form 200 "report of physical examinations" under the Selective Service and Form 221, WD-AGO, "report of induction of Selective Service man" should be amended to contain the following:

(a) A place for the examining physician to state whether, in his opinion, the physical defect causing rejection is remediable or correctible.

(b) The creation of subclassifications of I B and IV F (I B-R and IV F-R) to indicate whether the registrant is classified as suffering from a remediable or correctible physical defect.

(c) Statements to be signed by the registrant in these subclassifications relative to: (1) his willingness to undergo corrective and remediable procedures; (2) permission for release of information pertinent thereto, and (3) whether he will provide for appropriate treatment out of his own financial resources.

2. (a) Subparagraph (c) of paragraph 165 of the Selective Service regulations should be amended to permit the examination at any time of confidential records pertaining to the physical condition of a registrant by the governor of the state or his designated official representative.

(b) Subdivision (b) of paragraph 338 of the Selective Service regulations should be amended to provide appropriate parts of the report of physical examination, Form 200, in duplicate, and arrangements be made whereby one form may be retained temporarily for rehabilitation purposes by state selective service headquarters and state rehabilitation boards.

3. The following instructions should be issued by the National Director of Selective Service to all local boards:

When a local board has finally placed a registrant in Class I B-R or IV F-R, the chairman shall write to the registrant advising him of his classification and of the underlying condition that caused such classification, and shall inform him that the condition is considered remediable by the examining physician. He shall also advise the registrant to have the remediable defect corrected by his own physician or dentist or, if the registrant is unable to bear the necessary costs involved, he may have the work performed by applying to the appropriate agency or hospital in his area. For this purpose, the state director of Selective Service shall supply all chairmen of local boards with a list of agencies, hospitals or other institutions located in the neighborhood which are prepared to engage in this rehabilitation work during the period of national emergency. The chairman of the local board shall further advise the registrant of the time that the board has allowed for the correction of his defect, at the expiration of which time the registrant must present himself to the board for reexamination and reclassification.

4. In all states and local areas, rehabilitation committees should be created jointly by the Federal Security Agency and the Selective Service System to collaborate with professional groups and with local governmental and voluntary agencies in the development of local rehabilitation facilities.

5. Only a small percentage of the population can afford to pay or will be willing to pay for corrective measures which may make them available for military or industrial service, but which do not as yet interfere with their present civilian occupations. Communities differ greatly in the availability of medical facilities and some states and many local communities will be unable to provide the remediable measures that may be necessary to correct physical handicaps. Because of widespread shifting of population during and after the National Emergency, the responsibility is national

as well as local. In order to meet the situation realistically, it is recommended that Congress enact legislation to defray the cost. As this is primarily a matter of vital necessity for national defense, the cost should be met directly by federal defense appropriations to the Federal Security Agency, when needed, utilizing fully its available local medical, dental and hospital facilities. Without federal legislation of this nature, it can be predicted that little progress in voluntary physical rehabilitation is to be expected.

In the opinion of the Commission, the alternative to such a voluntary program is lower physical standards of eligibility for selective service and compulsory physical rehabilitation after induction into the Army. Action is required along the lines of one or the other of these alternatives, for the present standards of physical eligibility have reduced the nation's reservoir of eligible registrants to a number far lower than had been expected.

GEORGE BAEHR, M.D., *Chairman*
ARTHUR W. ALLEN, M.D.
FREDERIC A. BESLEY, M.D.
CHANNING FROTHINGHAM, M.D.
HARRY S. GRADLE, M.D.
M. T. MACEACHERN, M.D.
JOHN T. O'ROURKE, D.D.S.

A.M.A. TRIAL

THE objections made to a verdict holding the American Medical Association and the District Medical Society guilty of antitrust violation brought a denial on all counts from District Judge Proctor. At its annual meeting in June, the House of Delegates of the A.M.A. voted to carry the case to the Supreme Court in an effort to obtain a reversal of the decision.

CORRESPONDENCE

"OSTEOMYELITIC CONDITIONS OF THE MANDIBLE"

To the Editor:

I have read with interest the article in the June issue of THE JOURNAL by Van B. Dalton, D.D.S., entitled "Osteomyelitic Conditions of the Mandible." It has been my fortune, or perhaps I should say misfortune, to have had quite a number of osteomyelitis cases under observation and treatment, and for the most part I agree with Dr. Dalton in his conclusions as to treatment; viz., free drainage and removal of sequestra from healthy bone.

However, I am just a little at sea as to what I have treated in two or three cases of bone infection of the maxillae. In one paragraph, Dr. Dalton says: "In delving into the writings on this subject, it seems strange that all the papers written by dental practitioners have included the maxillae in the description and treatment of osteomyelitis. Not once have I found a dental writer limiting this subject to the mandible."

There is an old adage "A rose by any other name would smell as sweet," but if we do not see cases of osteomyelitis in the maxillae, even though rare, what should we call the disease?

In the American Illustrated Medical Dictionary, Seventeenth Edition, Dorland gives the following definition of osteomyelitis: "Inflammation of the bone marrow, or of the bone and marrow; an inflammation of the medullary cavity

of a bone." In the second edition of "Oral Surgery," by Mead, the same definition is given. Under etiology, Mead says: "The microorganisms involved in this disease are staphylococcus, streptococcus, pneumococcus, typhoid bacillus, and rarely the Bacillus coli communis. Osteomyelitis may occur in a healthy person without an open wound, as organisms may enter the blood stream through the tonsils, ears, nasal sinuses, teeth, or through the respiratory, intestinal, or genito-urinary membranes. In some of these cases, a contusion or trauma precedes the outbreak of the symptoms."

Taking these definitions and descriptions into consideration, I do not see how we can say that we have osteomyelitis of the mandible but not of the maxillae. As Paget says: "It is quite possible for an acute inflammation to be confined to the marrow of the cancellous bone or to any one point of the bone in view of the easy communication by means of the haversian canals and in long bones of the para-epiphyseal line. However, by common usage the convenient term 'osteomyelitis' has come to mean an inflammation of all the structures going to make up a bone."

Certainly we can have such an inflammation in the maxillae, and, technically correct or incorrect, the disease is considered osteomyelitis.

Dr. Dalton says, "Of course, we have cases closely resembling an osteomyelitis in the upper jaw, where, as a result of injury or infection, bone sequestra are formed, but these cases all lack that peculiar spreading tendency found in all true cases of osteomyelitis." In this connection, may I cite one case which came under my observation:

A man, aged 47, referred to me August 25, 1939, had had his upper anterior teeth extracted, without difficulty, under local anesthesia, August 4. The posterior teeth had been out for several months. When I first saw the patient, there was considerable swelling in the area of the left lateral incisor and cuspid. The temperature was 101° F. and the patient appeared to be very sick. Drainage was established through the soft tissues and bone and much pus was evacuated. Within a few days, the temperature was normal and the patient felt much better, but drainage of pus continued. The Wassermann reaction was negative, but a slide showed numerous streptococci and staphylococci.

Drainage was maintained until January 30, 1940, when two sequestra extending from the cuspid area to the tuberosity were removed. March 8, a sequestrum was removed extending from cuspid to midline, and, May 14, one extending from the midline to the right cuspid area was removed. The tissue immediately cleared up after removal of sequestra and, in June 1940, the prosthodontist inserted a denture with appliances to close the sinus openings (two) caused by removal of sequestra. The patient has steadily gained in health and weight since that time.

I am citing this case to show that sometimes we do have a "spreading tendency" even in the maxillae.

ELLIOTT H. ROWLAND, D.D.S.
569 Fourth Street,
San Bernardino, Calif.

OBITUARY

R. D. GRIFFIS, D.D.S.
(1869-1941)

ROBERT DARNELL GRIFFIS, president of the Texas State Dental Society in 1907, died July 5 at St. Joseph's Hospital, Paris, Texas, where he had been ill several weeks.

Dr. Griffis was born at Robertson Fork, Tenn., February 26, 1869. He graduated from Vanderbilt University with the D.D.S. degree in 1891. In the same year, he moved to Paris, Texas, where he spent the remainder of his life.

He was a member of the First District Dental Society of Texas, the Texas State Dental Society, the American Dental Association and the Order of Good Fellow, an associate member of the Southwestern Society of Orthodontia and formerly a member of the Texas State Board of Dental Examiners.

Dr. Griffis spent his whole professional life making dentistry a better profession and helping suffering humanity.

He was a regular attendant at all important dental meetings and his gentle and pleasing personality made him a general favorite with all who came to know him.

His wife died in 1928. Surviving are two daughters, Dr. Gladys Griffis and Miss Bonnie Marie Griffis, three nephews, Dr. W. M. Griffis and F. E. Griffis of Paris, and Guy Orr, Nashville, Tenn., and a niece, Mrs. J. E. Hood, Cottonwood, Arizona.

B. F. THIELEN.

DEATHS

ANDREWS, GEORGE JAY, New London, Iowa; Northwestern University Dental School, 1900; died May 16; aged 64.

CARROLL, WALTON C., Lieutenant Commander, Dental Corps, U. S. Navy; Georgetown University, School of Dentistry, 1910; died May 14; aged 54.

CARTER, WALTER JAMES, Lewiston, Maine; Tufts College Dental School, 1912; died June 10; aged 54.

DEMPSEY, PETER F., Waukon, Iowa; State University of Iowa, College of Dentistry, 1896; died May 20; aged 74.

FINEMAN, LOUIS, Pittsburgh, Pa.; University of Pittsburgh School of Dentistry, 1921; died July 10; aged 43.

FORNEY, J. ESTON, Keokuk, Iowa; Keokuk Dental College, 1902; died March 17.

GOEBEL, E. R., Lincoln, Ill.; Northwestern University Dental School, 1915; died May 13; aged 49.

HAYS, CLETUS T., Red Oak, Iowa; State University of Iowa, College of Dentistry, 1917; died March 23; aged 47.

HOLM, MARCEL L., Grand Junction, Iowa; State University of Iowa, College of Dentistry, 1922; died April 17; aged 40.

HOUSTON, TRIMBLE E., Corsicana, Texas; University of Tennessee College of Dentistry, 1895; died June 1; aged 65.

KNOWLES, SYDNEY J., Chicago, Ill.; Chicago College of Dental Surgery, 1901; died April 24.

LEONARD, WALTER M., Fort Wayne, Ind.; Western Reserve University School of Dentistry, 1902; died June 15; aged 60.

MANGOLD, ARTHUR, Chicago, Ill.; Chicago College of Dental Surgery, 1929; died recently, aged 41.

MANKER, L. M., Indianapolis, Ind.; Central College of Dentistry, 1902; died recently; aged 66.

MAXON, LON J., Bradenton, Fla., formerly of Cedar Rapids, Iowa, and Three Oaks, Mich.; State University of Iowa, College of Dentistry, 1901; died April 4; aged 64.

MERRITT, RALPH F., Albion, Mich.; University of Michigan School of Dentistry, 1905; died May 23; aged 61.

CURRENT LITERATURE

Studies on the Distribution of Radioactive Fluoride in Bones and Teeth of Experimental Animals

By J. F. Volker, R. F. Sognnaes and B. G. Bibby

Radioactive fluoride was given by intraperitoneal injection to five rats and by intravenous injection to four cats. Concentrations of the blood fluoride fell rapidly with a corresponding rise in the calcified tissue fluoride. The radioactive fluoride concentration of the various skeletal tissues was approximately directly proportional to their proximity to the circulating blood. Urinary excretion and salivary secretion of the isotope occurred in appreciable amounts only when the blood concentration was elevated. —*Am. J. Physiol.*, 132:707, April 1941.

J. F. Volker.

Statistical Comparison of Cultured and Non-Cultured Root Canal Cases

By Maurice Buchbinder

A report is presented on the result of root-canal therapy in 245 teeth most of which were single rooted teeth. A uniform standardized method of treatment was administered to the root canals, all of which contained necrotic pulps with roentgenographic evidence of apical involvement at the beginning of the treatment. Identical methods for filling the canals after treatment were employed. The work was done during the years 1930-1940. During the years 1930-1936, treatment of the canals was deemed sufficiently successful for filling on the basis of clinical evidence alone and without being checked by a culturing test. From 1936 to 1940, cultures were employed to determine whether the canals were ready for filling.

After an approximate average of twenty months from filling of the canals, the apical condition was determined to be normal in 69 per cent of all of the cases, while improvement was determined in 19.5 per cent of cases and failure in 11.5 per cent. Those in which filling was done on a basis of clinical evidence alone presented normal apical conditions in 63 per cent of its group, improvement in 19 per cent and failure in 18 per cent. In the group in which culturing was employed to determine whether the canals were ready for filling, 73 per cent were normal, 19 per cent showed improvement and 8 per cent were failures.

In a non-cultured group composed of seventy-six cases, the percentage of the normal was 0.776 and the percentage of failure 0.224. In a cultured group of 121 cases, the percentage of normal was 0.909, and the percentage of failure 0.091.

The statistics reveal that there were better results when culturing was used.—*J. D. Res.*, 20:92, April 1941.

Harry J. Healey.

Sulfonamide Chemotherapy of Dental Infections

By Leo Stern

The local application of sulfonamide chemotherapy was used in nearly 500 unselected patients, as a treatment for dry socket, and to control infection and relieve pain in compound fractures and after dental surgical work such as in impactions and cysts. Bacteriologically, little was found out because of the difficulty in getting oral cultures without contamination. The main finding was that the drug seemed to reduce the pain and, to a more limited degree, other untoward postoperative reactions of minor surgical wounds.—*J. D. Res.*, 20:143, April 1941.

E. C. Woods.

Distribution of Radioactive Phosphorus in the Tooth Enamel of Experimental Animals

By R. F. Sognnaes and J. F. Volker

The distribution of the isotope in the enamel following systemic administration of radioactive phosphorus has been studied in eight cats, five dogs and one monkey. The radiophosphorus metabolism in enamel of

fully erupted teeth is of considerably less magnitude than that of the dentin. The greatest concentration, 32, in the enamel was observed in the surface layer. The results indicate that the enamel is subject to mineral metabolism partly from within via the pulp and dentin and partly from without via the oral secretions.—*Am. J. Physiol.*, 133:112, May 1941.

J. F. VOLKER.

Emergency Treatment of War Injuries on the Face and Jaws

By R. H. IVY and R. A. STOUT

MUCH interest has been shown in recent years regarding the treatment of fractures of the jaws. The number of such fractures has been increased since the advent of the automobile, and more recently by the war. The points demanding special attention in the combat area are: (1) arrest of hemorrhage; (2) provision of an adequate respiratory airway; (3) temporary approximate reduction and fixation of bone fragments, and (4) provision of safe transportation from the combat zone to the hospital in the rear. The time required for the wounded to reach the general hospital varies considerably, but the desirability of safe, rapid evacuation to the place where definite treatment can be given is obvious. The measure outlined by the authors, if carried out properly, will insure the arrival at the base of a large percentage of cases of jaw injuries in good condition for definite treatment. The nature of the treatment required at the base depends to a large extent on the kind of preliminary care that has been given in the advanced zone.—*Ann. Surg.*, 113:1001-1009, June 1941.

J. T. GINN.

Anesthesia for Major Dental Surgery

By W. W. MUSHIN

WHILE endotracheal inhalation of anesthetics has definite advantages for dental operations, certain disadvantages exist. These are the difficulty of passing endotracheal tubes under light anesthesia and laryngoscopy, if blind intubation fails, and the increased liability to postoperative sore throat. To circumvent these, a technic of using tubes of large bone through the nostrils has been developed. These terminate opposite the glottis and are passed separately under preliminary nitrous oxide anesthesia. Thereafter, anesthesia is maintained through a special Y-shaped nasal attachment. Premedication is recommended. With this method, a variety of dental operations (in impactions, cysts, etc.) have been carried out under nitrous oxide on 230 patients. The method is contraindicated in large muscular men with short necks and in children under 5 years of age, or if one or both sides of the nose are blocked.—*Brit. M. J.*, 1:46, January 11, 1941.

B. G. BIBBY.

Consumption of Tobacco and Its Effect on the Oral Cavity of Greenlanders

By P. O. PEDERSEN

THIS article deals with some of the observations the author made on his expeditions to Greenland in 1935-1939.

Until recently, the Greenlanders had a peculiar way of preparing their tobacco for chewing which made it extremely tough and strong. Such preparation renders the tobacco exceedingly irritating to the paradentium. In the more uncivilized settlements, this primitive use of tobacco is still prevalent. The tobacco is usually placed in the lower buccal fold, where it may cause extensive local irritation. In some settlements on the East Greenland coast, as many as 71.2 per cent of the men and 45.3 per cent of the women above 36 years of age had tobacco paradentitis.

The different effects of tobacco, inflammation of the oral mucous membrane, gingivitis, paradentitis marginalis, chronic progressive, and abrasions from pipe and tobacco staining, are described as to frequency and occurrence.—*Zahnärtzl. Rund.*, 50:26, 1941.

F. BRUDEVALD.

Stimulation of the Muscles of Mastication

By P. J. BREKHUS, W. D. ARMSTRONG and W. J. SIMON

Two groups of male students were chosen for this experiment. The strength of the bite in pounds pressure of each member in both groups was recorded. Group 1 was not subjected to any experimental procedure. At the beginning of the experiment, the av-

erage bite pressure of this group, composed of sixty-two male students, was 135 pounds, and at the end of the experiment the pressure averaged 136 pounds. At the beginning of the experiment, the average bite pressure of Group 2, composed of forty-six male subjects, was 118 pounds. This group was given an assignment to chew 1 half inch cube of paraffin one hour each day for fifty consecutive days. At the end of the third week, a check bite was taken of the subjects in this group who were meeting their assignments. At this time, the average bite pressure was 140 pounds. After fifty consecutive days, another bite was made, and the average was found to be 142 pounds.

The authors concluded that the strength of the muscles of mastication is influenced by the amount of use, up to a physiologic limit, to which they are subjected.—*J. D. Res.*, 20:87-92, April 1941.

JAMES T. GINN.

Multiple Fractures of the Skull Complicated by Fractures of the Jaw

By SAMUEL W. GARFIN

IN a review of 4,100 patients with fractures of the skull, only 0.8 per cent had accompanying fracture of the jaws. The mortality of the skull fractures is about 25 per cent. Conservative treatment is advocated in all these cases.—*Am. J. Surg.*, 111:3, June 1941.

E. C. WOODS.

A Prosthetic Ulcer of the Mouth

By H. T. SIMMONS

ON the basis of twelve cases encountered in seven years, the author describes an ulcerated condition of the buccal sulcus associated with poorly fitting dentures. It is generally in the lower jaw in females. It presents a series of hard ridges paralleling the alveolus, the color being deeper than the surrounding mucosa, and ulceration exists in the furrows.

The hardness of the swelling and the induration of the base are suggestive of malignancy. This is not supported by the long duration of the lesion, the non-friable nature of the hypertrophied areas and the absence of bleeding. Microscopic examination reveals an irregular epithelial surface extending deeply into the underlying stroma, but limited by a definite membrana propria. The stroma shows scattered blood sinuses and foci of lymphoid cells indicative of chronic inflammation. Treatment consists of incision of ridges and coagulation of the base of the tumor with diathermy, followed by bland mouthwashes and a new denture.—*Brit. M. J.*, 1:119, January 1941.

B. G. BIBBY.

A Statistical Investigation of the Caries Prophylactic Effect of the Oslo Breakfast

By ERIK ALEXANDER

SEVEN hundred twenty-five children, 7-13 years of age, were examined as to increase of caries during a period of one year. One group of 412 children had the Oslo breakfast every day under supervision in the school. This breakfast included milk, dark bread with cheese and fresh vegetables or fruit. The other group, consisting of 313 children, did not have the Oslo breakfast.

The latter group developed on the average 1.85 new carious surfaces and 0.9 new carious teeth more in one year than did the group who had eaten the Oslo breakfast. A comparison of the carious surfaces in the two groups revealed the difference to be less pronounced between the proximal surfaces, while the difference between the pit and fissure surfaces was comparatively small.—*Den Norske Tannl. For. Tid.*, 51: 2, 1941.

F. BRUDEVALD.

Fractures of the Mandible

By M. S. STROCK

THE responsibility attending the care of fractures of the mandible has increased for the general surgeon as well as the dentist. Union of the fracture is no longer considered adequate. In addition, normal occlusion must be reestablished. The most important thing in the treatment of fractures of the mandible is the prompt reduction and immobilization. The author illustrates a method of treating these fractures by the application of a simple bandage and adhesive with elastic traction, which holds the mandible immobilized. This method is simple, inexpensive and easily applied. It has the advantage of allowing frequent in-

spection and cleaning of the teeth. It permits enough physiologic movement to promote the healing process and, in the latter days of fixation, the ingestion of semisolid food.—*Surg., Gynec. & Obst.*, 72:1047-1057, June 1941.

J. T. GINN.

Fluorine and Dental Caries

By DAGMAR C. WILSON

THE author reports finding mottled enamel in various countries of England in relation to various fluorine containing earths. These include Cumberland, Derbyshire, Durham and Westmoreland (fluorspar); Somerset (limestone and lias clay); Cornwall (china stone); Bedford and Buckinghamshire (lower greensand), and Bedfordshire, Berkshire, Gloucestershire, Oxfordshire and Wiltshire (Oxford clay). The Westmoreland area included one where freedom from caries had been recorded. An association was noted between nutritional adequacy and extent of fluorosis. Those where nutrition was good showed mild mottling; whereas, in those with "subnormal" nutrition, mottling was associated with pitting and attrition of the enamel. This confirmed previous observations in the Punjab.

A naked eye survey of 1,048 Somerset children showed that, in two groups, one with fluorosed and the other without fluorosed teeth, immunity to caries was associated with increased fluorine intake.—*Lancet*, 1:375, March 22, 1941.

B. G. BIBBY.

Orthodontic Treatment of Adult Patients

By KAARE REIBAN

IN the adult, the physiologic wandering of the teeth is mainly limited to a tooth movement in a mesial or distal direction. In dealing with orthodontic treatment of adults, the author states that it would be more natural to move the teeth in these directions and would tend to avoid expansion of the dental arch as the first step of the correction procedure. Extraction therapy combined with careful orthodontic treatment may lead to great esthetic and functional improvement.

The treatment of some cases is described in which extraction therapy was successfully used. The teeth were alined with fixed appliances. The individual tooth movement being accomplished, one may, during a second period of treatment, expand the jaw or adjust the position of the teeth by using an activator so as to obtain better function.—*Der Norske Tannl. For. Tid.*, 51:41, 1941.

F. BRUDEVALD.

Clinical Observations on the Local use of Sulfanilamide in Dentistry

By J. A. SINCLAIR

THE author reports some of the important findings from his three years' experience with locally applied sulfanilamide or its derivative, sulfapyridine. Some of his observations are as follows:

1. The drug will not prevent "dry-socket" if there has been excessive trauma. The reason for this is that there has been a disturbance in the circulation to the part. Pain is prevented, however, and infection controlled.

2. Administration of sulfanilamide causes a temporary lag in the filling in of sockets. This does not interfere with normal final healing time and postoperative x-ray films show normal bone formation following its use.

3. Swelling and fever do not follow extraction when the drug is used.

4. Vincent's infection, which is a mixed infection, does not respond well to local applications of sulfanilamide.

5. Thus far, drug incompatibility has not been observed.

6. The greatest clinical proof of the value of sulfanilamide is offered by the experience of William Lanier, of the United States Veterans Hospital at Oteen, N. C., where 6,800 dental sockets were dressed with sulfanilamide. The patients in this group all suffered from chronic infections, particularly tuberculosis. The wounds all healed satisfactorily.

The insertion of 1 grain of sulfanilamide in a molar tooth socket provides a concentration 1,300 times greater than the desirable 10 mg. per hundred cubic centimeters of blood serum indicated in generalized acute infections. The author recommends that the drug be used locally in this concentration in wounds following all extractions of teeth and other operations. The tablets are prefer-

able to the granules, but they should not exceed 1 grain. A space should be provided for the blood clot. Administered in this manner, a high concentration of the chemical is maintained over a long period of time. This is also an advantage over systemic administration.—*North Carolina M. J.*, 1: 579, November 1940.

JOHN E. BUHLER.

Amount of Organic Matter in Enamel from Several Types of Human Teeth

By MARTIN DEAKINS and J. F. VOLKER

A DETERMINATION of nitrogen-containing organic material in enamel was made on different types of human teeth and rat incisors, normal and fluorosed. It was found that the protein content of the enamel of human teeth varied from 0.49 per cent to 1.95 per cent. Rat incisor enamel from normal and fluorosed animals, analyzed by the same method, showed 2.97 per cent and 2.59 per cent, respectively. It was also found that the enamel of non-carious teeth contained more organic material than the non-carious enamel from carious teeth.—*J. D. Res.*, 20:117-121, April 1941.

JAMES T. GINN.

Relation of Oral Infection to the Circulatory System

By A. HENRY CLOGETT

IT may be said that, on the whole, people with heart disease have poorer teeth than the average. All surgical treatment of dental infections should be undertaken with the dental surgeon and physician working in close harmony. Extractions should be made on these patients only when indicated. Infections should be eliminated, but the possibility of initiating a subacute bacterial endocarditis in certain patients must be kept in mind.—*Mil. Surgeon*, 88:662, June 1941.

E. C. WOODS.

Fluorine in the Etiology of Endemic Goiter

By DAGMAR C. WILSON

THE author finds an association between areas where fluorine-containing rocks are present and the occurrence of hypothyroidism. Fifty-five of 378 children (5-14 years of age) in goitrous areas showed mottled enamel. None of 103 children in non-goitrous areas showed this condition. Distribution of goiter in Punjab corresponded to this, but this condition was absent in fishermen and fish eaters.

The author does not assert that fluorine ingestion is the only cause.—*Lancet*, 1:240, February 15, 1941.

B. G. BIBBY.

Duties of the Dental Officer in Naval Combat

By FRANCIS G. ULEN

OWING to the rapid expansion of the Navy, it is impossible for all of the dental officers to attend the course given at the Naval Dental School. The dental officer is expected to be familiar with the location, equipment and function of the battle dressing station, collecting stations repair parties, first aid boxes, etc. In battle, they are to be familiar with and able to assist the medical men in all phases of the care and treatment of the dead and wounded.—*U. S. Navy M. Bull.*, 39:2, April 1941.

E. C. WOODS.

Two Unusual Melanomas of the Alveolus and Maxilla

By N. B. SODERBERG and EARL C. PADGETT

TUMORS containing melanin pigment have been described as arising from pigmented nevi of the skin, mucous membrane of the mouth, nail bed, choroid, rectum, vagina, salivary tissue, meninges, spleen, adrenal gland and, less commonly, elsewhere.

These authors report two rare cases in which the upper alveolar process and maxilla were involved by melanomas. In the first case, a one-month-old girl presented a tumor beneath the upper lip on the right alveolar margin. The mass had a very thin capsule and, on section, had the appearance of deeply pigmented sarcomatous tissue. The diagnosis of teratomatous melanoma was made on the basis of three different types of tissue present, angiomatous, nerve and epithelial, which contained pigment. The tumor was probably not of a true invasive malignant nature at the time of removal.

In the second case, in a 3-month-old girl, the tumor mass was located in the left side of the maxilla. No capsule was noted and,

on cutting the tissue, the surface was found to vary from a somewhat glistening brown (hemorrhagic) to a deep black.

On microscopic section, the tissue was seen to be composed of a rather loose edematous fibrous stroma. Many spaces were lined by either flattened or more or less cuboidal epithelial cells, which contained a great amount of brown pigment. In some places, this pigment was pale or light brown; in others, it was black. Microscopically, the tumor had the appearance of a malignant neoplasm. This case might have presented a malignant stage of the condition seen in the first tumor.—*Am. J. Orthodontics,* 27:270, May 1941.

RAFAEL GARCIA.

Observations on Induced Dental Caries in Rats. 1. Reduction by Fluorides and Iodoacetic Acid

By F. J. MCCLURE and FRANCIS A. ARNOLD

THIS paper is the first of a series reporting some observations made on rat caries at the National Institute of Health. In it are recorded some of the data collected after tests with various fluorine and iodoacetic acid concentrations incorporated in the ration and drinking water of experimental rats. Galesburg and Quincy drinking waters and water containing two parts per million of fluorine were tested on litters from rats that had received these waters prior to and during gestation and lactation. The plan to test the effects of 125 parts per million of fluorine and iodoacetic acid did not involve any prior treatment of the breeding stock. Each litter of rats was represented in each group by one or two. No distinction was made as to sex. The Hoppert, Webber and Canniff caries-producing diet (*Science,* 74:77, 1931) was fed. The rats were kept on the experiment fifteen weeks, when they were killed and the teeth examined. Only cavities found by a 22.5 power microscope in unsectioned teeth were tabulated. Results are expressed as to (1) rats affected with caries, (2) teeth affected per group, (3) tooth areas affected (Cox's method) and (4) size of cavity (Cox's method).

The results of the experiment show that Galesburg and Quincy drinking water and water containing two parts per million of fluorine as sodium fluoride were inadequate to demonstrate a difference in the development of rat caries when the animals were placed on a cornmeal diet. The data do call attention, however, to a litter membership factor in rats with respect to their caries susceptibility. In other words, it appears that certain variations in rats grouped as to litter membership are truly abnormal as compared with the distribution of the data selected at random. The authors suggest that such results are significant and the entire question deserves further examination and study. Because of this, treatment of data on rats as of one group does not appear logical. In addition, such data may possess a natural grouping in accordance with prenatal and lactation effects.

The presence of 125 parts per million of fluorine as sodium fluoride in the food or water and the presence of 200 parts per million of iodoacetic acid in the drinking water significantly reduced the production of caries in rats. It is implied by the authors that the prevention of rat caries by administration of fluorine may in itself be taken as evidence against the belief that a mechanical factor is the essential feature of this phenomenon.—*J. D. Res.,* 20:97, April 1941.

VIRGIL D. CHEYNE.

Fractures of the Facial Bones

By JOHN B. ERICH

AN important detail in the surgical management of facial injuries and fractures lies in the fact that the cosmetic outcome is as significant to the patient as is the functional result. When lacerations are present, hydrogen peroxide proves effective in removing débris from the wound and leaving clean tissues for careful suturing.—*Mil. Surgeon,* 88:637, June 1941.

JAMES STRIEGEL.

Roentgenographic Diagnosis of Congenital Syphilis

By BERNARD G. SARNAT, ISAAC SCHOUR and ROBERT HEUPEL

THE authors present a case report to demonstrate the value of routine intra-oral roentgenograms of unerupted permanent teeth as an aid in the early diagnosis of congenital syphilis.

A diagnosis of congenital syphilis was

made on a negro girl at the age of 2 years and 2 months. Roentgenograms taken of the long bones were of no diagnostic value. The authors point out that the diagnosis could have been confirmed at that time by intra-oral roentgenograms, which would have shown characteristic dental abnormalities. Such roentgenograms, which were taken at the age of 4 years, showed permanent teeth which had gross morphologic characteristics of teeth observed in patients with congenital syphilis. This was confirmed by clinical examination at the age of 6 years.

The developing deciduous and permanent teeth were affected differently. Since the formation of the enamel of the deciduous teeth was going on at the time, hypoplasia was evidenced. The permanent teeth, which were active in morphodifferentiation, showed a disturbed dentino-enamel junction, with a resulting characteristic distortion of the crowns.

The authors advised that roentgenograms of the unerupted permanent teeth, as well as of the long bones, be used as an aid in the early diagnosis of congenital syphilis.—*J.A.M.A.*, 116:2745, June 21, 1941.

HARRY J. HEALEY.

Roentgen Irradiation in Cellulitis of the Face and Neck

By WILLIAM DEHOLLANDER

A REPORT on a series of eighteen cases of cellulitis of the neck and face treated by roentgen irradiation is given. Most of the cases followed the removal of teeth; one, a mastoidectomy. On admission, the temperatures ranged from 99.8 104° F., and the white blood counts ranged from 8,800 to 33,500. One of the eighteen patients died, but this death was attributed to family interference.

Early resolution, liquefaction and relief from pain usually occurred within twenty-four hours after irradiation. No extensive surgical incisions were necessary, one to three small ones usually sufficing. The temperature decreased with resolution. The toxicity of the patient decreased rapidly and only a minimum of hospitalization was necessary.

The theory of roentgen therapy is based upon the extreme sensitivity of leukocytes to these rays, under which they readily break down, with liberation into the area and into the blood stream of a protective substance or enzyme which is able to destroy the toxins produced by bacteria.—*Am. J. Roentgenol. & Rad. Therap.*, 45:831, June 1941.

JOHN E. BUHLER.

Effect of Storage Temperature on the Precipitable Protein and Catalase Activity of Whole Saliva

By MARTIN DEAKINS

A STUDY was made as to the effect of storage of saliva at room-temperature and icebox-temperature. It was found that the protein content of whole saliva decreased 42 per cent on standing twenty-four hours at 30° C., and its catalase activity was doubled. The protein content of centrifuged saliva decreased 34 per cent under the same conditions. At 0° C., no significant change took place in either the amount of protein or the catalase activity. It is suggested that all samples of saliva, whether collected for chemical analysis or for enzyme studies, should be collected and stored at 0° C.—*J. D. Res.*, 20:129-132, April 1941.

JAMES T. GINN.

The Treatment of Mixed Tumors of the Parotid Gland

By DAVID H. PATEY

THE natural course of mixed tumors of the parotid gland is to increase in size at varying rates, leading to a corresponding degree of deformity, but otherwise causing little disability. Spontaneous malignant changes in these tumors are rare. Surgical enucleation alone may be satisfactory, but these tumors tend to recur. A period of observation to determine the rate of growth may be advantageous. Irradiation alone is not a satisfactory form of treatment. It is suggested that the best treatment of these tumors is preoperative irradiation, which renders the capsule of the tumor tougher and less liable to rupture during operation, then complete enucleation, followed by irradiation.—*Brit. J. Surg.*, 28:29-38, July 1941.

JAMES T. GINN.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

AMERICAN ACADEMY OF PERIODONTOLOGY, Houston, Texas, October 23-25.

AMERICAN ASSOCIATION OF DENTAL EDITORS, Houston, Texas, October 25.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS, Houston, Texas, October 26-28.

AMERICAN COLLEGE OF DENTISTS, Houston, Texas, October 26.

AMERICAN CONGRESS OF PHYSICAL THERAPY, Washington, D. C., September 1-5.

AMERICAN DENTAL ASSISTANTS ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN OCCUPATIONAL THERAPY ASSOCIATION, Washington, D. C., September 1-5.

AMERICAN PUBLIC HEALTH ASSOCIATION, Atlantic City, N. J., October 14-17.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY, New York, N. Y., October 27.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS, Houston, Texas, October 23-25.

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION, Buffalo, N. Y., October 14-16.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

GREAT LAKES SOCIETY OF ORTHODONTISTS, Ann Arbor, Mich., November 3-4.

METROPOLITAN DENTAL SOCIETIES OFFICERS' CONFERENCE, Houston, Texas, October 29.

MIDCONTINENT DENTAL CONGRESS, St. Louis, Mo., November 17-19.

NATIONAL DENTAL ASSOCIATION, Richmond, Va., August 11-15.

GREATER NEW YORK DENTAL MEETING, December 1-5, New York.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA, Pittsburgh, November 11-13.

SOUTHERN SOCIETY OF ORTHODONTISTS, Raleigh, N. C., September 29-30.

WISCONSIN DENTAL ECONOMICS STUDY CLUB, Madison, August 8-9.

STATE SOCIETIES

September

Southern California, at Los Angeles (8-10)
Hawaii, at Honolulu

November

Ohio, at Columbus

December

Florida, at Hollywood (8-10)

STATE BOARDS OF DENTAL EXAMINERS

New Jersey, December 8-13. Walter A. Wilson, 150 E. State St., Trenton, Secretary.

AMERICAN ACADEMY OF PERIODONTOLOGY

THE American Academy of Periodontology will hold its twenty-eighth annual meeting at the Lamar Hotel, Houston, Texas, October 23-25.

RAYMOND E. JOHNSON, *Secretary*,
824 Lowry Medical Arts Bldg.,
St. Paul, Minn.

AMERICAN ASSOCIATION OF DENTAL EDITORS

THE American Association of Dental Editors will hold its annual meeting in the Rice Hotel, Houston, Texas, October 25. An all day program has been arranged and editors are urged to attend.

O. W. BRANDHORST, *Secretary*,
4952 Maryland Ave.,
St. Louis, Mo.

AMERICAN CONGRESS OF PHYSICAL THERAPY

THE twentieth annual scientific and clinical session of the American Congress of Physical Therapy will be held September 1-5 at the Mayflower Hotel, Washington, D. C. The mornings will be devoted to the annual instruction course and the afternoons and evenings to the scientific and clinical sessions. The seminar and convention proper will be open to all physicians and qualified technicians. For information concerning the seminar and preliminary program of the convention proper, address the American Congress of Physical Therapy, 30 North Michigan Ave., Chicago, Ill.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

THE annual meeting of the American Association of Public Health Dentists will be held in the Lamar Hotel, Houston, Texas, October 26-28.

FRANK C. CADY, *Secretary,*
U. S. P. H. S. Hospital,
Lexington, Ky.

AMERICAN COLLEGE OF DENTISTS

THE Houston convocation of the American College of Dentists will be held in the Rice Hotel, October 26, with morning, luncheon, afternoon and evening sessions.

O. W. BRANDHORST, *Secretary,*
4952 Maryland Ave.,
St. Louis, Mo.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

THE seventeenth annual session of the American Dental Assistants Association will be held in Houston, Texas, October 27-31. For further information, address

AILEEN M. FERGUSON,
General Secretary,
709 Centre St.,
Jamaica Plain, Mass.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

THE eighteenth annual meeting of the American Dental Hygienists' Association will be held in Houston, Texas, October 27-31. Headquarters, Lamar Hotel.

A. REBEKAH FISK, *Secretary,*
General Dispensary, U. S. Army,
Washington, D. C.

AMERICAN OCCUPATIONAL THERAPY ASSOCIATION

THE twenty-fifth annual meeting of the American Occupational Therapy Association will be held at the Mayflower Hotel, Washington, D. C., September 1-5. A combined meeting of the association with the American Congress of Physical Therapy will be held September 3. For further information, address

(MRS.) META R. COBB,
175 Fifth Ave.,
New York, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION

THE seventieth annual meeting of the American Public Health Association will be held in Atlantic City, N. J., October 14-17. Headquarters, Convention Hall; residence headquarters, Hotel Traymore. Ira V. Hiscock, professor of public health at the Yale School of Medicine, will speak at the luncheon session of the oral health group. Subject: "How Important Is the Dental Health Program? Nationally? Locally?"

WILLIMINA RAYNE WALSH,
Associate Secretary,
1790 Broadway,
New York, N. Y.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

THE fall meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held October 27 at the Midston House, Thirty-Eighth Street and Madison Avenue, New York, N. Y. Paul M. Wood, M.D., assistant clinical professor of anesthesia, New York Medical College, will speak on "Management of Emergencies in Dental Anesthesia." The scientific session at 8:30 p.m. will be preceded by an informal dinner at 7 o'clock, to which the profession is invited.

M. HILLEL FELDMAN, *Secretary,*
730 Fifth Ave.,
New York, N. Y.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

THE twenty-second annual meeting of the American Society of Oral Surgeons and Exodontists will be held in Houston, Texas, October 23-25, with headquarters at the Texas State Hotel.

HARRY BEAR, *Secretary,*
410 Professional Bldg.,
Richmond, Va.

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION

THE forty-first annual meeting of the University of Buffalo Dental Alumni Association will be held October 14-16 at Hotel Statler, Buffalo. The Eighth District Dental Society of the State of New York is cooperating in the development of the program. All ethical practitioners are invited.

JOHN D. LYNCH,
Chairman of Publicity.

GREAT LAKES SOCIETY OF ORTHODONTISTS

THE Great Lakes Society of Orthodontists will meet November 3-4 at Ann Arbor, Mich.

RICHARD E. BARNES, *Secretary,*
1704 Republic Bldg.,
Cleveland, Ohio.

INTERNATIONAL COLLEGE OF DENTISTS

THE United States Section of the International College of Dentists is sponsoring a movement to aid the dentists of Great Britain and China by providing them with badly needed supplies, instruments and small equipment used in the practice of dentistry. These will be collected and sent abroad by the Medical and Surgical Relief Committee of America. Any member of the dental profession or dental trade who can aid in this movement by contributions of such material is asked to communicate with Mrs. Rodgers Balcom, executive chairman of the Medical and Surgical Relief Committee of America, 420 Lexington Ave., New York, N. Y.

ELMER S. BEST, *Registrar,*
Medical Arts Bldg.,
Minneapolis, Minn.

METROPOLITAN DENTAL SOCIETIES OFFICERS' CONFERENCE

THE second annual Metropolitan Dental Societies Officers' Conference will be held at the Rice Hotel, Houston, Texas, October 29.

CHARLES H. JAMIESON, *Chairman,*
8545 Gratiot Ave.,
Detroit, Mich.

MIDCONTINENT DENTAL CONGRESS

THE Midcontinent Dental Congress will be held in St. Louis, Mo., November 17-19.

VAL H. FREDERICH, *Chairman,*
Exhibit Committee,
Arcade Bldg.,
St. Louis, Mo.

NATIONAL DENTAL ASSOCIATION

THE National Dental Association will convene for the twenty-eighth annual session August 11-15, in Richmond, Va. For further information, address

J. A. JACKSON, *Secretary,*
Charlottesville, Va.

GREATER NEW YORK DENTAL MEETING

THE Greater New York Dental Meeting will be held December 1-5 at the Hotel Pennsylvania, New York.

WALTER A. QUINN, *Chairman,*
Press & Publication,
Room 106A,
Hotel Pennsylvania,
New York.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

THE annual meeting of the Odontological Society of Western Pennsylvania will be held November 11-13 at the William Penn Hotel, Pittsburgh.

W. EARLE CRAIG, *Secretary,*
206 Jenkins Bldg.,
Pittsburgh.

SOUTHERN SOCIETY OF ORTHODONTISTS

THE next meeting of the Southern Society of Orthodontists will be held in Raleigh, N. C., September 29-30.

T. C. SPARKS, *Secretary,*
Medical Arts Bldg.,
Columbia, S. C.

WISCONSIN DENTAL ECONOMICS STUDY CLUB

THE Wisconsin Dental Economics Study Club will hold its eleventh regular annual meeting August 8-9 at the Hotel Loraine, Madison. The lectures and clinics presented will be confined to the subject of dental economics. All members of the American Dental Association are invited to attend. A registration fee of $5 admits the dentist and his wife and his dental assistants.

ALLERT LANGE, *Secretary,*
1 South Pinckney St.,
Madison.

FLORIDA STATE DENTAL SOCIETY

THE fifty-eighth meeting of the Florida State Dental Society will be held at the Hollywood Hotel, Hollywood, December 8-10.

WILLIAM P. WOOD, JR., *Secretary,*
442 W. Lafayette St.,
Tampa.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Southern California State Dental Association will be held September 8-10 at the Los Angeles Biltmore Hotel.

FRANCIS J. CONLEY, *Secretary,*
804 Professional Bldg.,
Los Angeles.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations commencing December 8 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application will be forwarded. Any person desiring to become a candidate must file the preliminary application blank, together with the examination fee of $25 on or before September 1.

WALTER A. WILSON, *Secretary,*
150 E. State St.,
Trenton.

BRONX HOSPITAL VOLUNTEERSHIPS

THE Dental Department of the Bronx Hospital offers a number of volunteerships to recent graduates in dentistry in the following branches: oral surgery and anesthesia; surgical pyorrhea; orthodontia; root canal therapy, and operative dentistry. Those offering satisfactory credentials indicating their interest in the clinical study of dental surgery as a health problem will receive consideration. Address applications to the Dental Department, Bronx Hospital, Fulton Ave. at 169th St., Bronx, New York. Appointments will begin in July.

DAVID WURZEL, *Director,*
Dental Department.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Carnegie Dental Fellow and, according to his interest, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Application should be made to

GEORGE H. WHIPPLE, *Dean,*
School of Medicine and Dentistry,
University of Rochester,
Rochester, N. Y.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING JUNE 1941

June 3

No. 2,243,950, EDMOND J. FRANWICK. Device for removing investments from sectional dental flasks.

No. 2,244,098, WILLIAM W. BUSICK. Toothbrush.

No. 2,244,409, WILLIAM F. UPTON. Camera mounting for dental bracket tables.

No. 2,244,615, LOUIS GARCIN. Toothbrush.

No. D-127,583, JOSEPH RALPH LA VICTES. Design for a laboratory unit.

June 10

No. 2,244,699, THEODORE A. HOSEY. Cleaning device for teeth.

No. 2,244,952, FELIX KAPELMAN. Dispensing device.

No. 2,244,969, ARTHUR E. SMITH. Ampoule syringe.

No. 2,245,036, CHESTER J. HENSCHEL. Spray device for dental instruments.

No. 2,245,065, HERBERT R. BERGER. Dental casting machine.

No. 2,245,288, FRANCIS J. MOYLAN. Dental device and method of utilizing the same.

No. 2,245,291, SIMON MYERSON. Blending implement.

No. 2,245,395, JULIUS M. GOLDBERG. X-ray angulator instrument.

No. 2,245,397, HERMAN HEILBORN. Articulator.

No. D-127,731, HYMAN W. BERGMAN. Design for a fountain toothbrush.

June 17

No. 2,245, 658, CLARENCE N. ERICKSON. Inhaling device.

No. 2,245,849, CHARLES S. BALLARD. Production of thermoplastic dentures.

No. 2,246,288, MAUDE BRAID. Dental alloy.

No. 2,246,332, JOSEPH O. WHITELEY. Process of producing molded articles.

June 24

No. 2,246,530, WILLIAM H. NITSCHKE. Dental engine.

No. 2,246,822, WALTER J. VAN ROSSEM. Method of controlling the physical dimensions of molded hydrocolloid bodies.

No. 2,246,867, ARTHUR J. THOMAS and MANLEY K. NASH. Toothbrush.

No. 2,247,003, WILL O. SMITH and ELIZABETH E. SMITH. Dental cleaning compact.

No. 2,247,013, LUCIAN GRAVES COBLE. Dental impression tray.

No. 2,247,258, BERNARD J. SHEPARD. Surgical instrument.